HOME OF HARMONY

Rehabilitation Project at Fort Apache

Fort Apache, Arizona

EDA Award No.: 07-79-07870

WEST PERSPECTIVE

NORTH PERSPECTIVE

SOUTH PERSPECTIVE

EAST PERSPECTIVE

August 4, 2023

Prepared by Specifications West, llc for:

Expires 06/30/25

SWABACK pllc

Architects + Planners

7550 East McDonald Drive
Scottsdale, Arizona, 85250
480.367.2100

SECTION 00 01 10

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DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 02 – EXISTING CONDITIONS

DIVISION 03 – CONCRETE

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INSTRUCTIONS TO BIDDERS

1.01 GENERAL

A. This Project will be partially funded with Federal funds from the United States Department of Commerce, Economic Development Administration, and therefore is subject to the Federal laws and regulations associated with that program.

B. The Form of Agreement will be AIA Document A101 – 2017 – Standard Form of Agreement Between Owner and Contractor.

C. The General Conditions will be AIA Document A201 – 2017 – General Conditions of the Contract for Construction.

D. Refer to U.S. Department of Commerce Economic Development Administration EDA Contracting Provisions for Construction.

1.02 DEFINITIONS

A. Bidding Documents include the Instructions to Bidders, the Bid Form, other sample Bidding and Contract forms and the proposed Contract Documents including any Addenda issued prior to receipt of Bids. The Contract Documents proposed for the work consist of the Owner-Contractor Agreement, the Conditions of the Contract (General, Supplementary and other Conditions if applicable), the Drawings, the Specifications and all Addenda issued prior to, and all Modifications issued after execution of the Contract.

B. All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201-2017, or in other Contract Documents are applicable to the Bidding Documents.

C. Addenda are written, or graphic instruments issued by the Architect prior to the execution of the Contract that modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

D. A Bid is a complete and properly signed proposal to do the work or designated portion for the sums stipulated therein, submitted in accordance with the Bidding Documents.

E. The Bid Price is the sum stated in the Bid for which the Bidder offers to perform the work described in Bid Documents.

1.03 ISSUING OF DOCUMENTS

A. Bid documents will be provided in a digital format only and will be made available for download in the manner(s) indicated in the Advertisement for Bid. Hard copies will not be provided by the FAHF or their agents and any printing and or distribution of hard copies will be the responsibility of the bidders.

1.04 EXAMINE DOCUMENTS AND VISIT SITE

A. Before submitting a Bid, Bidders shall carefully examine the Bidding Documents, visit the site of the work, fully inform themselves of existing conditions and limitations, including all items described in the Bidding Documents. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or work to be performed, it being understood that the tender of a Bid carries with it the agreement to all items and conditions referred to herein and indicated in the Bidding Documents.

1.05 DISCREPANCIES, AMBIGUITIES, OR CONFLICTS

A. Should a Bidder find discrepancies, ambiguities, or conflicts in the Bidding Documents, or should they be in doubt as to their meaning, notify the Architect, who will, time permitting, issue a written instruction in the form of an Addendum to all Bidders of record. Neither the Owner nor the Architect will be responsible for any oral explanations or interpretations of the Bidding Documents.

B. Any questions from the Bidders about the Bidding Documents must be made to the Architect no later than one week prior to Bid due date.

1.06 BID SECURITY

A. Bid Security, equal to ten percent (10%) of the amount bid, shall be submitted with each Bid.

B. Bid Security may be in the form of a bid bond, cashier's check, or certified check.

1.07 RECEIPT AND OPENING OF BIDS

A. The Architect: Gallup, Kit kgallup@swaback.com will receive Bids on behalf of the Owner.

B. On the Bid form included in the Project Manual, fill in all blanks appropriately.

C. Bids which are in any way conditional, or which make alternations, omissions, or reservations to the terms of the Bid Form or Bidding Documents may be rejected as incomplete, at the sole discretion of the Owner.

D. All figures are required, both in writing and in numerals. It shall be understood that, in the event of conflict between written quotations and numerical quotations, written quotations shall govern.

E. Each Bid shall show the full business address of the Bidder and be signed. A Bid by a partnership shall furnish the full names of all partners and shall be signed in the partnership name by one member of the partnership or by an authorized representative, followed by the signature and designation of the person signing. Bids by corporations, with corporate seal affixed, shall be signed with the legal name of the corporation followed by the name of the state of incorporation and by the signature and designation of the person authorized to bind it in the matter. The name of each person signing shall also be typed or printed below the respective signatures. When required by the Owner, satisfactory evidence of authority of the person signing on behalf of the corporation shall be furnished.

1.08 WITHDRAWAL OR REVISION BID

A. Any Bid may be withdrawn or revised prior to the scheduled time for receipt. Those Bids not withdrawn prior to the scheduled time for receipt of Bids may not be withdrawn for a period of thirty (60) calendar days thereafter without loss of Bid Security.

1.09 AWARD AND REJECTION OF BIDS

A. The Owner may award the Contract to the lowest, responsive bidder.

B. In awarding or rejecting Bids, the Owner reserves the following rights:

1. Identity of successful Bidder will not be determined at the time of opening Bids. The Owner reserves the right to obtain the opinion of Counsel on the legality and sufficiency of all Bids.

2. The Owner may reject all Bids and waive any irregularities in any Bid.

3. Request proof that the successful Bidder can provide performance and payment bonds as required.

C. Construction Duration Limitations arising from US EDA grant requirements:

1. Based on EDA Grant stipulations, the project must be completed by March 2, 2026. However, the owner prefers and welcomes an earlier completion period if achievable, which, based on grant requirements, cannot be a determining factor in the award.

1.10 DESIGNATION OF SUBCONTRACTORS

A. Within 72 hours after the time scheduled for receipt of Bids, Bidders shall submit to the Owner a listing of each Subcontractor who will perform work exceeding one-half of one percent of the Contract Price. Work exceeding the specified amount having no designated Subcontractor shall be performed by the Contractor.

1.11 SURETY BONDS

A. The successful Bidder shall furnish a Performance Bond and a Labor and Material Payment Bond, each in an amount equal to one hundred percent (100%) of the Contract Price, as security for the successful performance of the work and payment of persons performing labor and furnishing materials in connection with this Contract. The Bonds shall be executed by a surety company or companies acceptable to the Owner and authorized to execute such in the state in which the Project is located and shall be furnished within ten (10) calendar days after notification of acceptance of said Bid. Surety shall be made in favor of the Owner and shall cover the guarantee periods as well as the construction period. The cost of the Bonds shall be paid by the Contractor.

B. For contracts over $150,000, a 10% bid bond and 100% performance bond and payment bond are required.

1.12 PREVAILING WAGE RATES

A. The Contractor is required to pay the minimum wage rates required by the Davis-Bacon Act. Refer to Appendix document for a copy of the current requirements.

1.13 INSURANCE REQUIREMENTS

A. The bid proposal must be accompanied by a Blanket Certificate of Insurance for bidding purposes only, which states the specific insurance carried by the contractor. The contractor who is awarded the contract must provide a Certificate of Insurance naming the White Mountain Apache Tribe as an addition insured, and must specify that the contractor carries a minimum of Workers Compensation with $1M per accident, $1M each employee disease, and $1M disease policy

limit; General Liability Policy with a minimum of $5M each occurrence, personal and advertising injury, general aggregate, and products and completed operational aggregate, and builders risk insurance; an Umbrella of at least $5M; in addition to Auto Liability.

B. The Tribe will be notified of cancellation of insurance coverage.

1.14 NOTIFICATION TO AWARDED CONTRACTED OF REQUIREMENT TO PROVIDE SUB SCHEDULES

A. Due to grant funding requirements, the awarded contractor will be required to provide sub-schedules showing values correlated with applicable grants to keep billings separated by the different funding sources. Floor 1 and 2 rehabilitation is funded in part by a grant from US EDA; Masonry repair and modification is funded in part or whole by a grant from AZ State Parks; HVAC is funded by another grant from AZ State Parks.

END OF SECTION

SECTION 00 41 00

BID FORM

TO:

herein called the "Owner"

FOR: Fort Apache – Home of Harmony
EDA Award No.: 07-79-07870

PROPOSAL

The undersigned, having examined the site and become familiar with the proposed Contract Documents, including Addenda as acknowledged herein, and with knowledge of local conditions affecting the performance and costs of the Work, hereby proposes and agrees to perform the Work within the time proposed and as required by the proposed Contract Documents, for the following sums of money:

BASE BID PRICE

1. BASE BID: For Base Bid Work, exclusive of Cash Allowances and Alternates, the sum of:

_____

_____ Dollars ($_____).

ALTERNATES

The undersigned further proposes and agrees that if an Alternate listed hereinafter is incorporated in the Contract, the Base Bid Price will be adjusted by the amount indicated for the Alternate.

1. ALTERNATE NO. 1 – Lighting Control System: DEDUCT the sum of:

_____

_____ Dollars ($_____).

TIME OF COMPLETION

The undersigned further proposes and agrees to complete the Work in _____ (_____) calendar days.

BID SECURITY

The required ten percent 10% Bid Security for this Bid is attached in the form of:

( ) Bid Bond issued by _____.

( ) Certified or Cashier's Check No. _____ issued by

_____.

ADDENDA

The undersigned acknowledges receipt of the following Addenda and has provided for all changes in this Bid.

None ( )

Addendum No. _____, dated _____

Addendum No. _____, dated _____

Addendum No. _____, dated _____

Addendum No. _____, dated _____

Addendum No. _____, dated _____

List of additional Addenda is attached. ( )

DESIGNATION OF SUBCONTRACTORS

Refer to Attachment at the end of this Section.

ACCEPTANCE

The Owner may accept the Bid from the lowest, responsive Bidder.

The Owner reserves the right to reject this Bid, however, this Bid shall remain open and shall not be withdrawn for a period of thirty (60) days from the date set for its receipt.

If written notice of the acceptance of this Bid is mailed or delivered to the undersigned within thirty (60) days after the date set for the receipt, or at any other time thereafter before it is withdrawn, the undersigned will execute and deliver the Contract, the Performance Bond, Labor and Material Payment Bond, and proof of insurance coverage, to the Owner within ten (10) days after receipt of the notification of acceptance of this Bid.

Notice of acceptance or request for additional information may be addressed to the undersigned at the address set forth below.

BIDDER'S BUSINESS INFORMATION

A. Business Name: _____

Officer Authorized to Sign: _____

Title: _____

Type of Business: Individual ( ); Partnership( ); Corporation ( ).

Address: _____

_____

Telephone: _____

B. Contractor License No. _____, State of _____

AFFIRMATION

Signed on this date of _____ , 2023

_____ _____

Signature Title

also referred to as "Bidder."

END OF SECTION

DESIGNATION OF SUBCONTRACTORS

The following list indicates the type of Work, name, and business address of each Subcontractor who will perform Work exceeding one-half of one percent of the Contract Price, exclusive of Alternates. Work exceeding the specified amount having no designated Subcontract will be performed by the Undersigned.

Type of Work to Be Performed	Subcontractor's Business Name	Business Address

Continuation list of Subcontractors is attached. ( )

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Fort Apache Heritage Foundation
P.O. Box 507
Fort Apache, AZ 85926

and the Contractor:
(Name, legal status, address and other information)

TBD

for the following Project:
(Name, location and detailed description)

Renovation of the Boys' Dormitory, Building 116
Fort Apache, Arizona

The Architect:
(Name, legal status, address and other information)

SWABACK, pllc
7550 E. McDonald Dr, Suite A
Scottsdale, AZ 85250

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
rock excavation for the elevator pit (as occurs)	$10,000
rock excavation for trenching for the four-pipe system from the Central Plant (as occurs)	$60,000

§ 4.4 Unit prices, if any:
and lift and $60,000 for trenching for the four-pipe system from the Central Plant
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

Under the provisions of the General Conditions of the Contract for Construction, Liquidated Damages for the total project shall be $500.00 per calendar day, shall be assessed in accordance with the General Conditions, and due the Owner after expiration of the contract time for substantial completion including Sundays and legal holidays until substantial completion is achieved.

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: 10 percent

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

Additions and Deletions Report for

AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 10:58:12 PT on 08/03/2023.

PAGE 1

Fort Apache Heritage Foundation
P.O. Box 507
Fort Apache, AZ 85926

...

TBD

...

Renovation of the Boys' Dormitory, Building 116
Fort Apache, Arizona

...

SWABACK, pllc
7550 E. McDonald Dr, Suite A
Scottsdale, AZ 85250

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:58:12 PT on 08/03/2023 under Order No. 2114443852 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Renovation of the Boys' Dormitory, Building 116
Fort Apache, Arizona

THE OWNER:
(Name, legal status and address)

Fort Apache Heritage Foundation
P.O. Box 507
Fort Apache, AZ 85926

THE ARCHITECT:
(Name, legal status and address)

SWABACK, pllc
7550 E. McDonald Dr, Suite A
Scottsdale, AZ 85250

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

Additions and Deletions Report for

AIA® Document A201® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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PAGE 1

Renovation of the Boys' Dormitory, Building 116
Fort Apache, Arizona

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Fort Apache Heritage Foundation
P.O. Box 507
Fort Apache, AZ 85926

...

SWABACK, pllc
7550 E. McDonald Dr, Suite A
Scottsdale, AZ 85250

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:58:21 PT on 08/03/2023 under Order No. 2114443852 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

OMB Number: 0610-0096
Expiration Date: 01/31/2025

U. S. DEPARTMENT OF COMMERCE
ECONOMIC DEVELOPMENT ADMINISTRATION

EDA CONTRACTING PROVISIONS
FOR CONSTRUCTION PROJECTS

These EDA Contracting Provisions for Construction Projects (EDA Contracting Provisions) are intended for use by recipients receiving federal assistance from the U. S. Department of Commerce - Economic Development Administration (EDA). They contain provisions specific to EDA and other federal provisions not normally found in non-federal contract documents. The requirements contained herein must be incorporated into all construction contracts and subcontracts funded wholly or in part with federal assistance from EDA.

TABLE OF CONTENTS

1. DEFINITIONS

Agreement – The written instrument that is evidence of the agreement between the Owner and the Contractor overseeing the Work.

Architect/Engineer - The person or other entity engaged by the Recipient to perform architectural, engineering, design, and other services related to the work as provided for in the contract.

Contract – The entire and integrated written agreement between the Owner and the Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

Contract Documents – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents.

Contractor – The individual or entity with whom the Owner has entered into the Agreement.

Drawings or Plans – That part of the Contract Documents prepared or approved by the Architect/Engineer that graphically shows the scope, extent, and character of the Work to be performed by the Contractor.

EDA - The United States of America acting through the Economic Development Administration of the U.S. Department of Commerce or any other person designated to act on its behalf. EDA has agreed to provide financial assistance to the Owner, which includes assistance in financing the Work to be performed under this Contract. Notwithstanding EDA's role, nothing in this Contract shall be construed to create any contractual relationship between the Contractor and EDA.

Owner – The individual or entity with whom the Contractor has entered into the Agreement and for whom the Work is to be performed.

Project – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

Recipient – A non-Federal entity receiving a Federal financial assistance award directly from EDA to carry out an activity under an EDA program, including any EDA-approved successor to the entity.

Specifications – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

Subcontractor – An individual or entity having direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

Work – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

2. APPLICABILITY

The Project to which the construction work covered by this Contract pertains is being assisted by the United States of America through federal assistance provided by the U.S. Department of Commerce - Economic Development Administration (EDA). Neither EDA, nor any of its departments, entities, or employees is a party to this Contract. The following EDA Contracting Provisions are included in this Contract and all subcontracts or related instruments pursuant to the provisions applicable to such federal assistance from EDA.

3. FEDERALLY REQUIRED CONTRACT PROVISIONS

(a) All contracts in excess of the simplified acquisition threshold - currently fixed at $150,000 (*see* 41 U.S.C. §§ 134 and 1908) must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.

(b) All contracts in excess of $10,000 must address termination for cause and for convenience by the Recipient including the manner by which it will be effected and the basis for settlement.

(c) All construction contracts awarded in excess of $10,000 by recipients of federal assistance and their contractors or subcontractors shall contain a provision requiring compliance with Executive Order 11246 of September 24, 1965, *Equal Employment Opportunity*, as amended by Executive Order 11375 of October 13, 1967, and Department of Labor implementing regulations at 41 C.F.R. part 60.

(d) All prime construction contracts in excess of $2,000 awarded by Recipients must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. §§ 3141-3148) as supplemented by Department of Labor regulations at 29 C.F.R. part 5. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. § 874 and 40 U.S.C. § 3145) as supplemented by Department of Labor regulations at 29 C.F.R. part 3.

(e) All contracts awarded by the Recipient in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704 (the Contract Work Hours and Safety Standards Act) as supplemented by Department of Labor regulations at 29 C.F.R. part 5.

(f) All contracts must include EDA requirements and regulations that involve a requirement on the contractor or sub-contractor to report information to EDA, the Recipient or any other federal agency.

(g) All contracts must include EDA requirements and regulations pertaining to patent rights with respect to any discovery or invention which arises or is developed in the course of or under such contract.

(h) All contracts must include EDA requirements and regulations pertaining to copyrights and rights in data.

(i) All contracts and subgrants in excess of $150,000 must contain a provision that requires compliance with all applicable standards, orders, or requirements issued under the Clean Air Act (42 U.S.C. § 7401 *et seq.*) and the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 *et seq.*), and Executive Order 11738, *Providing for Administration of the Clean Air Act and the Federal Water Pollution Control Act With Respect to Federal Contracts, Grants, or Loans*.

(j) Contracts must contain mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C.§ 6201).

(k) Contracts must contain a provision ensuring that contracts are not to be made to parties on the government wide Excluded Parties List System in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. part 180.

(l) Contracts must contain a provision ensure compliance with the Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352) under which contractors that apply or bid for an award of $100,000 or more must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(m) If the Recipient is a state agency or agency of a political subdivision of a state, any contract awarded must contain a provision ensuring compliance with section 6002 of the Solid Waste Disposal Act (42 U.S.C. § 6962), as amended by the Resource Conservation and Recovery Act related to the procurement of recovered materials.

4. REQUIRED PROVISIONS DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the contract shall forthwith be physically amended to make such insertion of correction.

5. INSPECTION BY EDA REPRESENTATIVES

The authorized representatives and agents of EDA shall be permitted to inspect all work, materials, payrolls, personnel records, invoices of materials, and other relevant data and records.

6. EXAMINATION AND RETENTION OF CONTRACTOR'S RECORDS

(a) The Owner, EDA, or the Comptroller General of the United States, or any of their duly authorized representatives shall, generally until three years after final payment under this contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

(b) The Contractor agrees to include in first-tier subcontracts under this contract a clause substantially the same as paragraph (a) above. "Subcontract," as used in this clause, excludes purchase orders that do not exceed $10,000.

(c) The periods of access and examination in paragraphs (a) and (b) above for records relating to (1) appeals under the disputes clause of this contract, (2) litigation or settlement of claims arising from the performance of this contract, or (3) costs and expenses of this contract to which the Owner, EDA, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

7. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in a form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due to the Contractor in accordance with the progress schedule. The Contractor also shall furnish the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only to determine the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

8. CONTRACTOR'S TITLE TO MATERIAL

No materials, supplies, or equipment for the work shall be purchased by the Contractor or by any subcontractor that is subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants and guarantees that he/she has good title to all work, materials, and equipment used by him/her in the Work, free and clear of all liens, claims, or encumbrances.

9. INSPECTION AND TESTING OF MATERIALS

All materials and equipment used in the completion of the Work shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. Materials of construction, particularly those upon which the strength and durability of any structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for intended uses.

10. "OR EQUAL" CLAUSE

Whenever a material, article, or piece of equipment is identified in the Contract Documents by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard. Any material, article, or equipment of other manufacturers and vendors that will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the Architect/Engineer, of equal substance and function. However, such substitution material, article, or equipment shall not be purchased or installed by the Contractor without the Architect/Engineer's written approval.

11. PATENT FEES AND ROYALTIES

(a) Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device that is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Architect/Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Owner in the Contract Documents.

(b) To the fullest extent permitted by Laws and Regulations, the Contractor shall indemnify and hold harmless the Owner and the Architect/Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

12. CLAIMS FOR EXTRA COSTS

No claims for extra work or cost shall be allowed unless the same was done in pursuance of a written order from the Architect/Engineer approved by the Owner.

13. CONTRACTORS AND SUBCONTRACTORS INSURANCE

(a) The Contractor shall not commence work under this Contract until the Contractor has obtained all insurance reasonably required by the Owner, nor shall the Contractor allow any subcontractor to commence work on his/her subcontract until the insurance required of the subcontractor has been so obtained and approved.

(b) Types of insurance normally required are:

(1) Workers' Compensation
(2) Contractor's Public Liability and Property Damage
(3) Contractor's Vehicle Liability
(4) Subcontractors' Public Liability, Property Damage and Vehicle Liability
(5) Builder's Risk (Fire and Extended Coverage)

(c) **Scope of Insurance and Special Hazards:** The insurance obtained, which is described above, shall provide adequate protection for the Contractor and his/her subcontractors, respectively, against damage claims that may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by him/her and also against any of the special hazards that may be encountered in the performance of this Contract.

(d) **Proof of Carriage of Insurance:** The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates, and dates of expiration of applicable insurance policies.

14. CONTRACT SECURITY BONDS

(a) If the amount of this Contract exceeds $150,000, the Contractor shall furnish a performance bond in an amount at least equal to one hundred percent (100%) of the Contract price as security for the faithful performance of this Contract and also a payment bond in an amount equal to one hundred percent (100%) of the Contract price or in a penal sum not less than that prescribed by State, Territorial, or local law, as security for the payment of all persons performing labor on the Work under this Contract and furnishing materials in connection with this Contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law. Before final acceptance, each bond must be approved by EDA. If the amount of this Contract does not exceed $150,000, the Owner shall specify the amount of the payment and performance bonds.

(b) All bonds shall be in the form prescribed by the Contract Documents except as otherwise provided in applicable laws or regulations, and shall be executed by such sureties as are named in the current list of *Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies* as published in Treasury Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's

authority to act. Surety companies executing the bonds must also be authorized to transact business in the state where the Work is located.

15. **LABOR STANDARDS - DAVIS-BACON AND RELATED ACTS**
(as required by section 602 of PWEDA)

(a) **Minimum Wages**

(1) All laborers and mechanics employed or working upon the site of the Work in the construction or development of the Project will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act at 29 C.F.R. part 3, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at the time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor, which is attached hereto and made a part hereof, regardless of any contractual relationship that may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 C.F.R. § 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 C.F.R. § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates determined under 29 C.F.R. § 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) (i) Any class of laborers or mechanics to be employed under the Contract, but not listed in the wage determination, shall be classified in conformance with the wage determination. EDA shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(A) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(B) The classification is utilized in the area by the construction industry; and

(C) The proposed wage rate, including any bona fide fringe benefits, bears a

reasonable relationship to the wage rates contained in the wage determination.

(ii) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and EDA or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by EDA or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210.

(iii) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and EDA or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), EDA or its designee shall refer the questions, including the views of all interested parties and the recommendation of EDA or its designee, to the Administrator for determination.

(iv) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(2)(ii) or (iii) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(3) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(4) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(b) **Withholding**

EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper employed or working on the site of the Work in the construction or development of the Project, all or part of the wages required by the Contract, EDA or its designee may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations

have ceased. EDA or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

(c) **Payrolls and basic records**

(1) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the Work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the Work in the construction or development of the Project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. § 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, the plan or program is financially responsible, and the plan or program has been communicated in writing to the laborers or mechanics affected, and provide records that show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) (i) For each week in which Contract work is performed, the Contractor shall submit a copy of all payrolls to the Owner for transmission to EDA or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. part 5.5(a)(3)(i). This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose. It may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, D.C. 20402; or downloaded from the U.S. Department of Labor's website at https://www.dol.gov/whd/forms/wh347.pdf. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors

(ii) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the Contract and shall certify the following:

(A) That the payroll for the payroll period contains the information required to be maintained under 29 C.F.R. § 5.5(a)(3)(i) and that such information is correct and complete;

(B) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 C.F.R. part 3; and

(C) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(iii) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 15(c)(2)(ii) of this section.

(iv) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of Title 18 and section 3729 of Title 31 of the U.S. Code.

(3) The Contractor or subcontractor shall make the records required under paragraph 15(c)(1) of this section available for inspection, copying, or transcription by authorized representatives of EDA or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, EDA or its designee may, after written notice to the Contractor or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. § 5.12.

(d) **Apprentices and Trainees**.

(1) **Apprentices**. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training (Bureau), or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any

apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a Project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) **Trainees**. Except as provided in 29 C.F.R. § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program that has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(3) **Equal employment opportunity**. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity

requirements of Executive Order 11246, *Equal Employment Opportunity*, as amended, and 29 C.F.R. part 30.

(e) **Compliance with Copeland Anti-Kickback Act Requirements**. The Contractor shall comply with the Copeland Anti-Kickback Act (18 U.S.C. § 874 and 40 U.S.C. § 3145) as supplemented by Department of Labor regulations (29 C.F.R. part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that the Contractor and any subcontractors shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which they are otherwise entitled. The Owner shall report all suspected or reported violations to EDA.

(f) **Subcontracts**. The Contractor and any subcontractors will insert in any subcontracts the clauses contained in 29 C.F.R. §§ 5.5(a)(1) through (10) and such other clauses as EDA or its designee may require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. § 5.5.

(g) **Contract termination; debarment**. The breach of the contract clauses in 29 C.F.R. § 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. § 5.12.

(h) **Compliance with Davis-Bacon and Related Act Requirements**. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 C.F.R. parts 1, 3, and 5 are herein incorporated by reference in this contract.

(i) **Disputes concerning labor standards**. Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and EDA or its designee, the U.S. Department of Labor, or the employees or their representatives.

(j) **Certification of Eligibility**.

(1)By entering into this Contract, the Contractor certifies that neither it nor any person or firm that has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(2) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

16. LABOR STANDARDS - CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(a) **Overtime requirements**. No Contractor or subcontractor contracting for any part of the Contract work, which may require or involve the employment of laborers or mechanics, shall require or permit any such laborer or mechanic in any workweek in which that person is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(b) **Violation; liability for unpaid wages, liquidated damages**. In the event of any violation of the clause set forth in paragraph (a) of this section, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a) of this section.

(c) **Withholding for unpaid wages and liquidated damages**. EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or subcontractor under any such Contract or any other federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) of this section.

(d) **Subcontracts**. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (a) through (c) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a) through (c) of this section.

17. EQUAL EMPLOYMENT OPPORTUNITY

(a) The Recipient hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 C.F.R. chapter 60, which is paid for in whole or in part with funds obtained from EDA, the following equal opportunity clause:

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments hereunder, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965 and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by EDA and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of

this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally-assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

(8) The Contractor will include the portion of the sentence immediately preceding paragraph 17(a)(1) and the provisions of paragraphs 17(a)(1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as EDA or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance. Provided, however, that in the event the Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by EDA or the Secretary of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

(9) The Recipient further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally-assisted construction work. Provided, however, that if the Recipient so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality, or subdivision of such government that does not participate in work on or under the Contract.

(10)The Recipient agrees that it will assist and cooperate actively with EDA and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish EDA and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist EDA in the discharge of the EDA's primary responsibility for securing compliance.

(11) The Recipient further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by EDA or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the Recipient agrees that if it fails or refuses to comply with these undertakings, EDA may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this EDA financial assistance; refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case

to the Department of Justice for appropriate legal proceedings.

(b) Exemptions to Above Equal Opportunity Clause (41 C.F.R. chapter 60):

(1) Contracts and subcontracts not exceeding $10,000 (other than Government bills of lading, and other than contracts and subcontracts with depositories of Federal funds in any amount and with financial institutions which are issuing and paying agents for U.S. savings bonds and savings notes) are exempt. The amount of the Contract, rather than the amount of the federal financial assistance, shall govern in determining the applicability of this exemption.

(2) Except in the case of subcontractors for the performance of construction work at the site of construction, the clause shall not be required to be inserted in subcontracts below the second tier.

(3) Contracts and subcontracts not exceeding $10,000 for standard commercial supplies or raw materials are exempt.

18. **CONTRACTING WITH SMALL, MINORITY AND WOMEN'S BUSINESSES**

(a) If the Contractor intends to let any subcontracts for a portion of the work, the Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services.

(b) Affirmative steps shall consist of:

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(2) Ensuring that small and minority businesses and women's business enterprises are solicited whenever they are potential sources;

(3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;

(4) Establishing delivery schedules, where the requirements of the contract permit, which encourage participation by small and minority businesses and women's business enterprises;

(5) Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies;

(6) Requiring each party to a subcontract to take the affirmative steps of this section; and

(7) The Contractor is encouraged to procure goods and services from labor surplus area firms.

19. **HEALTH, SAFETY, AND ACCIDENT PREVENTION**

(a) In performing this contract, the Contractor shall:

(1) Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to their health and/or safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation;

(2) Protect the lives, health, and safety of other persons;

(3) Prevent damage to property, materials, supplies, and equipment; and

(4) Avoid work interruptions.

(b) For these purposes, the Contractor shall:

(1) Comply with regulations and standards issued by the Secretary of Labor at 29 C.F.R. part 1926. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 3701 – 3708); and

(2) Include the terms of this clause in every subcontract so that such terms will be binding on each subcontractor.

(c) The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this Contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 C.F.R. part 1904.

(d) The Owner shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the Work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to take corrective action promptly, the Owner may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under these circumstances.

(e) The Contractor shall be responsible for its subcontractors' compliance with the provisions of this clause. The Contractor shall take such action with respect to any subcontract as EDA, or the Secretary of Labor shall direct as a means of enforcing such provisions.

20. CONFLICT OF INTEREST AND OTHER PROHIBITED INTERESTS

(a) No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part hereof.

(b) No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

(c) The Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the Contract Documents has a corporate or financial affiliation with the supplier or manufacturer.

(d) The Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, may be involved. Such a conflict may arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in the Contractor. The Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors, or anything of monetary value from the Contractor or subcontractors.

(e) If the Owner finds after a notice and hearing that the Contractor, or any of the Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of the Owner or EDA in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, the Owner may, by written notice to the Contractor, terminate this Contract. The Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which the Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

(f) In the event this Contract is terminated as provided in paragraph (e) of this section, the Owner may pursue the same remedies against the Contractor as it could pursue in the event of a breach of this Contract by the Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, the Owner may pursue exemplary damages in an amount (as determined by the Owner) which shall not be less than three nor more than ten times the costs the Contractor incurs in providing any such gratuities to any such officer or employee.

21. RESTRICTIONS ON LOBBYING

(a) This Contract, or subcontract is subject to 31 U.S.C. § 1352, regarding lobbying restrictions. The section is explained in the common rule, 15 C.F.R. part 28 (55 FR 6736-6748, February 26, 1990). Each bidder under this Contract or subcontract is generally prohibited from using federal funds for lobbying the Executive or Legislative Branches of the Federal Government in connection with this EDA Award.

(b) **Contract Clause Threshold**: This Contract Clause regarding lobbying must be included in each bid for a contract or subcontract exceeding $100,000 of federal funds at any tier under the EDA Award.

(c) **Certification and Disclosure**: Each bidder of a contract or subcontract exceeding $100,000 of federal funds at any tier under the federal Award must file Form CD-512, *Certification Regarding Lobbying – Lower Tier Covered Transactions*, and, if applicable, Standard Form-LLL, *Disclosure of Lobbying Activities*, regarding the use of any nonfederal funds for lobbying. Certifications shall be retained by the Contractor or subcontractor at the next higher tier. All disclosure forms, however, shall be forwarded from tier to tier until received by the Recipient of the EDA Award, who shall forward all disclosure forms to EDA.

(d) **Continuing Disclosure Requirement**: Each Contractor or subcontractor that is subject to the Certification and Disclosure provision of this Contract Clause is required to file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by such person. Disclosure forms shall be forwarded from tier to tier until received by the Recipient of the EDA Award, who shall forward all disclosure forms to EDA.

(e) **Indian Tribes, Tribal Organizations, or Other Indian Organizations**: Indian tribes, tribal organizations, or any other Indian organizations, including Alaskan Native organizations, are excluded from the above lobbying restrictions and reporting requirements, but only with respect to expenditures that are by such tribes or organizations for lobbying activities permitted by other federal law. An Indian tribe or organization that is seeking an exclusion from Certification and Disclosure requirements must provide EDA with the citation of the provision or provisions of federal law upon which it relies to conduct lobbying activities that would otherwise be subject to the prohibitions in and to the Certification and Disclosure requirements of 31 U.S.C. § 1352, preferably through an attorney's opinion. Note, also, that a non-Indian subrecipient, contractor, or subcontractor under an award to an Indian tribe, for example, is subject to the restrictions and reporting requirements.

22. HISTORICAL AND ARCHAEOLOGICAL DATA PRESERVATION

The Contractor agrees to facilitate the preservation and enhancement of structures and objects of historical, architectural or archaeological significance and when such items are found and/or unearthed during the course of project construction. Any excavation by the Contractor that uncovers an historical or archaeological artifact shall be immediately reported to the Owner and a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the State Historic

Preservation Officer (SHPO) for recovery of the items. *See* the National Historic Preservation Act of 1966 (54 U.S.C. § 300101 *et seq.*, formerly at 16 U.S.C. § 470 *et seq.*) and Executive Order No. 11593 of May 31, 1971.

23. **CLEAN AIR AND WATER**

Applicable to Contracts in Excess of $150,000

(a) **Definition**. "Facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by the Contractor or any subcontractor, used in the performance of the Contract or any subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the United States Environmental Protection Agency (EPA) determines that independent facilities are collocated in one geographical area.

(b) In compliance with regulations issued by the EPA, 2 C.F.R. part 1532, pursuant to the Clean Air Act, as amended (42 U.S.C. § 7401 *et seq.*); the Federal Water Pollution Control Act, as amended (33 U.S.C. § 1251 *et seq.*); and Executive Order 11738, the Contractor agrees to:

(1) Not utilize any facility in the performance of this contract or any subcontract which is listed on the Excluded Parties List System, part of the System for Award Management (SAM), pursuant to 2 C.F.R. part 1532 for the duration of time that the facility remains on the list;

(2) Promptly notify the Owner if a facility the Contractor intends to use in the performance of this contract is on the Excluded Parties List System or the Contractor knows that it has been recommended to be placed on the List;

(3) Comply with all requirements of the Clean Air Act and the Federal Water Pollution Control Act, including the requirements of section 114 of the Clean Air Act and section 308 of the Federal Water Pollution Control Act, and all applicable clean air and clean water standards; and

(4) Include or cause to be included the provisions of this clause in every subcontract and take such action as EDA may direct as a means of enforcing such provisions.

24. **USE OF LEAD-BASED PAINTS ON RESIDENTIAL STRUCTURES**

(a) If the work under this Contract involves construction or rehabilitation of residential structures over $5,000, the Contractor shall comply with the Lead-based Paint Poisoning Prevention Act (42 U.S.C. § 4831). The Contractor shall assure that paint or other surface coatings used in a residential property does not contain lead equal to or in excess of 1.0 milligram per square centimeter or 0.5 percent by weight or 5,000 parts per million (ppm) by weight. For purposes of this section, "residential property" means a dwelling unit, common areas, building exterior surfaces, and any surrounding land, including outbuildings, fences and play equipment affixed to the land, belonging to an owner and available for use by residents, but not

including land used for agricultural, commercial, industrial or other non-residential purposes, and not including paint on the pavement of parking lots, garages, or roadways.

(b) As a condition to receiving assistance under PWEDA, recipients shall assure that the restriction against the use of lead-based paint is included in all contracts and subcontracts involving the use of federal funds.

25. ENERGY EFFICIENCY

The Contractor shall comply with all standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201) for the State in which the Work under the Contract is performed.

26. ENVIRONMENTAL REQUIREMENTS

When constructing a Project involving trenching and/or other related earth excavations, the Contractor shall comply with the following environmental constraints:

(1) **Wetlands**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert wetlands.

(2) **Floodplains**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency (FEMA) Floodplain Maps, or other appropriate maps, i.e., alluvial soils on Natural Resource Conservation Service (NRCS) Soil Survey Maps.

(3) **Endangered Species**. The Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of the Contractor, the Contractor will immediately report this evidence to the Owner and a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the U.S. Fish and Wildlife Service.

27. DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSIONS

As required by Executive Orders 12549 and 12689, *Debarment and Suspension*, 2 C.F.R. Part 180 and implemented by the Department of Commerce at 2 C.F.R. part 1326, for prospective participants in lower tier covered transactions (except subcontracts for goods or services under the $25,000 small purchase threshold unless the subrecipient will have a critical influence on or substantive control over the award), the Contractor agrees that:

(1) By entering into this Contract, the Contractor and subcontractors certify, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared

ineligible, or voluntarily excluded from participation in this Contract by any federal department or agency.

(2) Where the Contractor or subcontractors are unable to certify to any of the statements in this certification, the Contractor or subcontractors shall attach an explanation to this bid.

See also 2 C.F.R. part 180 and 2 C.F.R. § 200.342.

28. **EDA PROJECT SIGN**

The Contractor shall supply, erect, and maintain in good condition a Project sign according to the specifications provided by EDA. To the extent practical, the sign should be a free standing sign. Project signs shall not be located on public highway rights-of-way. Location and height of signs will be coordinated with the local agency responsible for highway or street safety in the Project area, if any possibility exists for obstructing vehicular traffic line of sight. Whenever the EDA site sign specifications conflict with State law or local ordinances, the EDA Regional Director will permit such conflicting specifications to be modified so as to comply with State law or local ordinance.

29. **BUY AMERICA**

To the greatest extent practicable, contractors are encouraged to purchase American-made equipment and products with funding provided under EDA financial assistance awards.

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The work of this Contract comprises renovation and rehabilitation of the Boy's Dormitory Building #116 at 116 Geronimo Street in Fort Apache, Arizona.

B. Perform work in accordance with the codes, ordinances, and amendments in effect in the location of the Project.

1.02 CONTRACTS

A. Perform the work per the Agreement to be executed between the Owner and Contractor.

1.03 WORK SEQUENCE

A. Perform the work in a single phase.

1.04 ACCESS TO SITE

A. Notify the City and County agencies, as applicable, a minimum of 48-hours in advance of performing work which necessitates closing or interfering with traffic on public thoroughfares. Obtain written permission prior to effecting such closures and interruptions.

1.05 CONTRACTOR USE OF PREMISES

A. During the construction period, the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the Project.

1.06 ADJACENT SITE CONDITION SURVEY

A. Prior to commencement of work, jointly survey the site, paving, plant life, and other items with the Owner, noting and recording existing damage such as cracks, sags, unhealthy plant life, and other damage.

B. This record shall serve as a basis for determination of subsequent damage to these items due to settlement, movement, or Contractor's operations.

C. Existing damage observed shall be marked and the official record of existing damage shall be signed by the parties making the survey.

D. Cracks, sags, and damage to the site, paving, plant life, and other items not noted in the original survey but subsequently observed shall be reported immediately to the Architect.

1.07 PROTECTION OF EXISTING UTILITIES

A. The Drawings may not show all existing above and below grade drainage lines; storm drains; sewers; water, gas, and electrical lines; and other existing utilities in the area of the work.

B. Locate these existing installations before proceeding with excavation or other operations which may cause damage, maintain them in service where appropriate, and repair damage caused by the performance of the work, at no increase in the Contract Sum.

C. Additional compensation or extension of time due to below grade structures not shown or brought to the Contractor's attention, including reasonable action taken to protect, relocate, and repair damage to same, shall be determined as specified in the General Conditions.

1.08 USE AND OCCUPANCY OF WORK PRIOR TO ACCEPTANCE BY OWNER

A. The Owner may use and occupy the building before formal acceptance under the following conditions:

1. A Certificate of Substantial Completion shall be prepared and executed as provided in the General Conditions. The Certificate of Substantial Completion shall be accompanied by a written endorsement of the Contractor's insurance carrier and surety permitting occupancy by the Owner during the remaining period of the work.

2. Occupancy by the Owner shall not be construed as being an acceptance of that part of the work occupied.

3. The Contractor will not be held responsible for damage to the occupied part of the work resulting from the Owner's occupancy.

4. Occupancy by the Owner shall not be deemed to constitute a waiver of existing claims the Owner or Contractor may have against each other.

5. If required by the Owner for areas it has occupied, the Contractor shall make available, on a 24 hour-a-day, 7 day-a-week basis, utility services, heating, and cooling which are in condition to be put in operation when such use and occupancy is taken. Responsibility for the operation and maintenance shall remain with the Contractor until the building is complete and the areas occupied, at which time operation and maintenance shall be assumed by the Owner if Contract requirements for such equipment have been met.

6. Make an itemized list of each piece of equipment operated during occupancy, with the date operation commences; submit to the Architect, who will transmit it to the Owner. This list shall be the basis for the commencement of guarantee/warranty periods on the equipment operated during the Owner's occupancy.

7. The Owner will pay for utility costs associated with occupancy during construction.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes administrative and procedural requirements governing allowances.

1. Selected materials and equipment are specified by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

1.02 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the work.

B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the work.

C. Purchase products and systems selected by the Architect from the designated supplier.

1.03 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.04 UNUSED MATERIALS

A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

1. When requested by the Architect, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Architect, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include the sum of $10.00/sq. ft for the purchase of tile indicated and specified in Section 09 30 00.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Furnish and install products specified, under options and conditions for substitutions stated in this Section.

1. Use the Substitution Request Form attached at the end of this Section.

B. Related Sections:

1. Common product requirements are specified in Section 01 61 00.

1.02 SUBSTITUTIONS

A. Catalog numbers and specific brands or trade names are used in conjunction with material and equipment required by the Specifications to establish the standard of quality, utility, and appearance required. Substitutions which are equal in quality, utility, and appearance to those specified may be accepted subject to the following provisions:

1. Substitutions shall be accepted in writing by the Architect.

2. The determination of the Architect shall be final.

3. Failure of Contractor to submit proposed substitutions for approval in the manner described above and within the time prescribed shall be sufficient cause for disapproval by the Architect of any substitutions otherwise proposed.

4. The Architect will accept, in writing, proposed substitutions that are in Architect's opinion equal in quality, utility, and appearance to the material or equipment specified.

5. Such acceptance shall not relieve Contractor from complying with the requirements of the Drawings and Specifications.

6. Contractor shall be responsible for costs of any changes resulting from Contractor's proposed substitution which affect other parts of the work or the work of Separate Contractors, including the cost of the Architect's additional services, testing, permits thereby made necessary.

B. Requests for substitutions will only be considered if the Contractor submits the following:

1. PDF copy of completed Submittal Form attached at the end of this Section.

2. Complete technical data including drawings, performance specifications, samples, and test reports of the article proposed for substitution; and any additional information required by the Architect.

3. Complete breakdown of costs, including savings generated by the proposed substitution. For guaranteed maximum price Contracts, include the amount, if any, to be deducted from the Contract Sum if the proposed substitution is accepted.

4. Statement by the Contractor that the proposed substitution is in full compliance with the requirements of the Contract Documents and Applicable Code Requirements.

5. List of other trades, if any, which may be affected by the substitution.

6. If the proposed substitution requires that portions of the Project be redesigned or construction be removed in order to accommodate the substituted item, submit design and engineering calculations prepared by a properly licensed design professional. The Contractor shall bear all costs resulting from the substitution.

C. Submit a separate request form for each substitution. Support each request with:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents.

   a. Product identification including manufacturer's name and address.

   b. Manufacturer's literature including products description, reference standards and performance and test data.

   c. Samples, as applicable.

   d. Name and address of similar projects on which product has been used, and date of each installation.

2. Itemized comparison of the proposed substitution with specified product. List significant variations.

3. Data relating to changes in construction schedule.

4. Any effect of substitution on separate contracts.

5. List of changes required on other work or products.

6. Accurate cost data comparing proposed substitution with specified product.

7. Designation of availability of maintenance services, sources of replacement materials.

D. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from the Contractor.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

4. Insufficient information is submitted.

E. Substitutions shall be considered as a Change Order and be approved by the Architect prior to fabrication or installation.

1.03 CONTRACTOR'S REPRESENTATION

A. In making a formal request for substitution, Contractor represents that they:

1. Have investigated proposed product and has determined that it is equal to or superior to that specified.

2. Will provide same warranties for substitution as for product specified.

3. Will coordinate installation of accepted substitution into the work and will make such changes as may be required for the work to be complete in all respects.

4. Waives claims for additional costs caused by substitution which may subsequently become apparent.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

Advancement of Construction Technology

SUBSTITUTION REQUEST
(After the Bidding Phase)

Project: _____ Substitution Request Number: For the Architect to fill in.

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached – REQUIRED BY A/E.

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

Form Version: June 2004
CSI Form 13.1A

SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.

☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

_____

_____

_____

_____

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:

1. Requests for Interpretation (RFI) are specified in Section 01 26 15.

1.02 CHANGE ORDER PROPOSAL REQUESTS

A. Owner- or Architect-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.

1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Architect for review an estimate of cost necessary to execute the proposed change.

a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Indicate the amount of overhead and profit.

d. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining the reasons for the change and the effect of the change on the work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include the amount of overhead and profit.

5. Comply with requirements in Section 01 25 00 if the proposed change in the work requires the substitution of one product or system for a product or system specified.

6. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests or a form acceptable to the Architect.

C. Supplemental Instructions from the Architect (ASI): Use AIA Form G710 or a form furnished by the Owner's Representative.

1.03 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714 instructing the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

C. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.04 CHANGE ORDER PROCEDURES

A. Upon approval of a Change Order Proposal Request, the Contractor shall issue a Change Order for signatures of the Owner or Owner's Representative, Architect, and Contractor on AIA Form G701.

1.05 LIMITS ON PROFIT AND OVERHEAD FOR CHANGE ORDERS

	Overhead	Profit
Subcontractors and the General Contractor for work performed with their own forces	10%	5%
Subcontractors and the General Contractor on work performed by other than his own forces	5%	5%

END OF SECTION

SECTION 01 26 15

REQUESTS FOR INTERPRETATION (RFI)

PART 1 – GENERAL

1.01 GENERAL

A. This Section contains the procedures to be followed by the Contractor upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or upon having any question concerning interpretation.

1.02 DEFINITIONS

A. Requests for Interpretation: A request from the Contractor seeking an interpretation or a clarification of some requirement of the Contract Documents. The Contractor shall clearly set forth the issue requiring clarification or interpretation and why a response is needed. Responses from the Architect will not change any requirements of the Contract Documents.

B. Drawing/Plan Clarification: An answer from the Architect in response to an inquiry from the Contractor, intended to make some requirement(s) of the Drawings understood. Drawing/plan clarifications may be sketches, drawings, or in narrative form and will not change any requirements of the Drawings.

C. Non-Conformance Notice: A notice issued by the Architect documenting that the work or some portion thereof has not been performed in accordance with the requirements of the Contract Documents. Payment will not be made on any portion of the work for which a Non-Conformance Notice has been issued and the work not corrected to the Satisfaction of the Architect. Upon receipt of a Non-Conformance Notice, the Contractor shall provide a written response within 5 working days after receipt, noting why they believe the work was performed in accordance with the Contract Documents or what corrective action they intend to take to correct the non-conforming work. Written responses from the Contractor are not considered to be RFI's.

D. Project Communications: Routine written communications between the Architect and Contractor shall be in writing, field memo, or e-mail. Such communications shall not be identified as RFI's.

1.03 PROCEDURES

A. Notification by Contractor:

1. Submit requests for clarification of additional information in PDF format to the Architect using the Request for Interpretation (RFI) Form attached at the end of this Section or other form approved by the Architect.

2. Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix as necessary for each resubmission. For example, the first RFI would be "1"; the second RFI would be "2." The first resubmittal of RFI "2" would be "2a", etc.

3. Limit each RFI to one subject.

4. Submit an RFI if one of the following conditions occurs:

a. The Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.

b. The Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or cannot be reasonably inferred from the intent of the Contract Documents.

c. The Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.

5. RFIs will not be recognized or accepted if, in the opinion of Architect, one of the following conditions exists:

a. The Contractor submits the RFI as a request for substitution.

b. The Contractor submits the RFI as a submittal.

c. The Contractor submits the RFI under pretense of a Contract Documents discrepancy or omission without thorough review of the Contract Documents.

d. The Contractor submits the RFI in a manner that suggests that specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.

e. The Contractor submits an RFI in an untimely manner without proper coordination and scheduling of Work of related trades.

6. Ask for any clarification or request for interpretation immediately upon discovery. Submit RFIs in a reasonable time frame so as not to affect the Contract Schedule while allowing the full response time specified below.

1.04 RESPONSE TIME

A. The Architect, whose decision will be final and conclusive, will resolve such questions and issue instructions to the Contractor within a reasonable time frame. In most cases, RFIs will receive a response within 10 working days. In some cases, this time may need to be lengthened for complex issues, or shortened for emergency situations, as mutually agreed in writing.

B. Should the Contractor proceed with the work affected before receipt of a response from the Architect, within the response time specified above, any portion of the work that is not done in accordance with the Architect's interpretations, clarifications, instructions, or decisions is subject to removal or replacement and the Contractor shall be responsible for all resultant losses.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

REQUEST FOR INTERPRETATION

Project: _____ R.F.I. Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Section: Paragraph: Drawing Reference: Detail:

Request:

Signed by: Date:

Response:

☐ Attachments

Response From: To: Date Received: Date Returned:

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section includes progress payment procedures.

B. Related Sections:

1. Schedule of values is specified in Section 01 29 73.

1.02 APPLICATIONS FOR PAYMENT

A. Payment Application Times: Each progress payment date shall be agreed to by the Owner.

B. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Application for Payment.

C. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

D. Transmittal: Submit PDF copy of each Application for Payment to the Architect including waivers of lien and similar attachments, when required.

E. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of Mechanics Lien from every entity who may lawfully be entitled to file a lien arising out of the Contract, and related to the work covered by the payment.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full waivers.

3. The Owner reserves the right to designate which entities involved in the work must submit waivers.

4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.

5. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of work covered by the application who could lawfully be entitled to a lien.

6. Waiver Forms: Submit waivers of lien on forms, and executed in a manner acceptable to Owner.

F. Initial Application for Payment: Administrative actions and submittals that shall precede or coincide with submittal of the first Application for Payment include the following:

1. List of subcontractors.

2. List of principal suppliers and fabricators.

3. Schedule of Values.

4. Contractor's Construction Schedule (preliminary if not final).

5. Schedule of principal products.

6. Schedule of unit prices, if any.

7. Submittal Schedule (preliminary if not final).

8. List of Contractor's staff assignments.

9. List of Contractor's principal consultants.

10. Copies of building permits.

11. Copies of authorizations and licenses from governing authorities for performance of the work.

12. Initial progress report.

13. Report of pre-construction meeting.

14. Certificates of insurance and insurance policies.

15. Performance and payment bonds (if required).

16. Data needed to acquire Owner's insurance.

17. Initial settlement survey and damage report, if required.

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit Payment Application. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.

1. Administrative actions and submittals that shall proceed or coincide with this application include:

a. Occupancy permits and similar approvals.

b. Warranties (guarantees) and maintenance agreements.

c. Test/adjust/balance records.

d. Maintenance instructions.

e. Meter readings.

f. Start-up performance reports.

g. Change-over information related to Owner's occupancy, use, operation and maintenance.

h. Final cleaning.

i. Application for reduction of retainage, and consent of surety.

j. Advice on shifting insurance coverage.

k. Final progress photographs.

l. List of incomplete work recognized as exceptions to Architect's Certificate of Substantial Completion.

H. Payment Retainage: As specified in the General Conditions of the Contract for Construction.

I. Final Payment Application: Administrative actions and submittals which shall precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.

2. Completion of items specified for completion after Substantial Completion.

3. Assurance that unsettled claims will be settled.

4. Assurance that work not complete and accepted will be completed without undue delay.

5. Transmittal of required Project construction records to Owner.

6. Certified property survey.

7. Proof taxes, fees and similar obligations have been paid.

8. Removal of temporary facilities and services.

9. Removal of surplus materials, rubbish and similar elements.

10. Change of door locks to Owner's access.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements governing the preparation of a Schedule of Values.

B. Related Sections:

1. Payment procedures are specified in Section 01 29 00.

1.02 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Construction Schedule.

B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

1. Contractor's construction schedule.

2. Application for Payment form.

3. List of subcontractors.

4. Schedule of allowances.

5. Schedule of alternates.

6. List of products.

7. List of principal suppliers and fabricators.

8. Schedule of submittals.

C. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 7-days before the date scheduled for submittal of the initial Application for Payment.

D. Sub-Schedules: Where the work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

E. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.

b. Name of the Architect.

c. Project number.

d. Contractor's name and address.

e. Date of submittal.

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

a. Generic name.

b. Related Specification Section.

c. Name of subcontractor.

d. Name of manufacturer or fabricator.

e. Name of supplier.

f. Change Orders (numbers) that have affected value.

g. Dollar value.

h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

5. For each part of the work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the work.

F. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

1. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

G. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

PART 2 – PRODUCTS

Not Used.

PART 3 – NOTIFICATION TO AWARDED CONTRACTED OF REQUIREMENT TO PROVIDE SUB SCHEDULES

A. Due to grant funding requirements, the awarded contractor will be required to provide sub-schedules showing values correlated with applicable grants to keep billings separated by the different funding sources. Floor 1 and 2 rehabilitation is funded in part by a grant from US EDA; Masonry repair and modification is funded in part or whole by a grant from AZ State Parks; HVAC is funded by another grant from AZ State Parks.

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

1. Coordination.

2. Administrative and supervisory personnel.

3. General installation provisions.

4. Cleaning and protection.

1.02 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project Close-out activities.

1.03 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the interrelationship of components shown on separate Shop Drawings.

2. Indicate required installation sequences.

3. Comply with requirements contained in Section 01 33 00.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

A. General: The provisions in this Article are in addition to and are intended to supplement specific installation requirements specified in other Sections.

B. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and the conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

C. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

G. Recheck measurements and dimensions before starting each installation.

H. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

I. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

J. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.02 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference.

2. Pre-Installation Conferences.

3. Coordination Meetings.

4. Progress Meetings.

5. Warranty Closeout Meeting.

1.02 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the Project site no later than 15-days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Contractor shall take and distribute meeting notes to the attendees. Attendees taking exception to any item on the meeting notes shall notify the Contractor within 3 days following receipt.

C. Attendees:

1. Owner's Representative.

2. Owner personnel as appropriate; representative from Physical Plant, Business Office, and Security, as applicable.

3. Architect and applicable professional consultants.

4. Contractor.

5. Contractor's Superintendent.

6. Major subcontractors.

7. Others as appropriate.

D. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule.

2. Critical work sequencing.

3. Designation of responsible personnel.

4. Procedures for processing field decisions and Change Orders.

5. Procedures for processing Applications for Payment.

6. Distribution of Contract Documents.

7. Submittal of Shop Drawings, Product Data and Samples.

8. Preparation of record documents.

9. Use of the premises.

10. Office, work and storage areas.

11. Equipment deliveries and priorities.

12. Safety procedures.

13. First aid.

14. Security.

15. Housekeeping.

16. Working hours.

17. Green Building requirements.

1.03 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

B. Review the progress of other construction activities and preparations for the activity under consideration at each pre-installation conference, including requirements for:

1. Contract Documents.

2. Options.

3. Related Change Orders.

4. Purchases.

5. Deliveries.

6. Shop Drawings, Product Data, and quality control Samples.

7. Possible conflicts.

8. Compatibility problems.

9. Time schedules.

10. Weather limitations.

11. Manufacturer's recommendations.

12. Compatibility of materials.

13. Acceptability of substrates.

14. Temporary facilities.

15. Space and access limitations.

16. Governing regulations.

17. Safety.

18. Inspection and testing requirements.

19. Required performance results.

20. Recording requirements.

21. Protection.

C. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner's Representative and Architect.

D. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

1.04 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner's Representative and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees:

1. Owner's Representative.

2. Architect and applicable professional consultants.

3. Contractor.

4. Contractor's Superintendent.

5. Subcontractors as appropriate to the agenda.

6. Suppliers as appropriate to the agenda.

7. Others as appropriate to the agenda.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress, Include topics for discussion as appropriate to the status of the Project.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

E. Review the present and future needs of each entity present, including such items as:

1. Interface requirements.
2. Time.
3. Sequences.
4. Deliveries.
5. Off-site fabrication problems.
6. Access.
7. Site utilization.
8. Temporary facilities and services.
9. Hours of work.
10. Hazards and risks.
11. Housekeeping.
12. Quality and work standards.
13. Change Orders.
14. Documentation of information for payment requests.

F. Reporting: Take and distribute copies of minutes of the meeting to each party present and to other parties who should have been present no later than 3-days after each progress meeting date. Include a summary, in narrative form, of progress since the previous meeting and report.

G. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.05 WARRANTY CLOSEOUT MEETING

A. Eleven months following date of Substantial Completion, hold a meeting to review warranties, bonds, and service and maintenance contracts for materials and equipment. Take action as appropriate to implement, repair, or replace defective items and to extend service and maintenance contracts.

B. Attending shall be:

1. Owner's Representative.
2. Architect and professional consultants, as appropriate.
3. Contractor.
4. Subcontractor, as appropriate to the agenda.
5. Suppliers, as appropriate to the agenda.
6. Others, as appropriate to the agenda.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Payment procedures are specified in Section 01 29 00.

2. Operation and maintenance data are specified in Section 01 78 23.

3. Project record documents are specified in Section 01 78 39.

1.02 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the work are indicated on approved submittal schedule.

3. Coordinate transmittal of different types of submittals for related parts of the work so processing will not be delayed because of the need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the work to permit processing, including re-submittals.

1. Initial Review: Allow 15-days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 21-days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15-days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., Project Name-06 10 00.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., Project Name-06 10 00.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner**,** containing the following information:

a. Project name.

b. Date.

c. Name and address of Architect.

d. Name of Contractor.

e. Name of subcontractor.

f. Name of supplier.

g. Name of manufacturer.

f. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).

g. Number and title of appropriate Specification Section.

h. Drawing number and detail references, as appropriate.

i. Location(s) where product is to be installed, as appropriate.

j. Other necessary identification.

k. Submittal and transmittal distribution record.

l. Remarks.

D. Options: Identify options requiring selection by Architect.

E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include the same identification information as related submittal.

F. Re-submittals: Make re-submittals in the same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

4. The Architect will review up to one re-submittal. If more than one re-submittal is required, any associated costs from additional reviews by the Architect will be charged to the Contractor and processed as a deductive Change Order in accordance with the General Conditions.

G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a statement that includes the signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications.

B. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit a revised submittal schedule to reflect changes in status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.

    b. Specification Section number and title.

    c. Name of subcontractor.

    d. Description of the work covered.

    e. Scheduled date for Architect's final release or approval.

    f. Scheduled date of fabrication.

    g. Scheduled dates for purchasing.

    h. Scheduled dates for installation.

    i. Activity or event number.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

   a. Manufacturer's catalog cuts.

   b. Manufacturer's product specifications.

   c. Standard color charts.

   d. Statement of compliance with specified referenced standards.

   e. Testing by recognized testing agency.

   f. Application of testing agency labels and seals.

   g. Notation of coordination requirements.

   h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

   a. Wiring diagrams showing factory-installed wiring.

   b. Printed performance curves.

   c. Operational range diagrams.

   d. Clearances required for other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data as a PDF electronic file.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Identification of products.

   b. Schedules.

   c. Compliance with specified standards.

   d. Notation of coordination requirements.

   e. Notation of dimensions established by field measurement.

   f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2-inches x 11-inches, but no larger than 30-inches x 42-inches.

3. Submit Shop Drawings as a PDF electronic file.

E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.

b. Product name and name of manufacturer.

c. Sample source.

d. Number and title of applicable Specification Section.

e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine the final acceptance of construction associated with each set.

a. Samples that may be incorporated into the work are specified in individual Specification Sections. Such Samples shall be in an undamaged condition at time of use.

b. Samples not incorporated into the work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

F. Product Schedule: If specified in individual Specification Sections, prepare a written summary indicating types of products required for the work and their intended location. Include the following information in tabular form:

   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.

   2. Manufacturer and product name, and model number if applicable.

   3. Number and name of room or space.

   4. Location within room or space.

   5. Submit product schedule as a PDF electronic file.

G. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00.

H. Contractor's Construction Schedule: Comply with requirements specified in Section 01 33 00.

I. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00.

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00.

K. Maintenance Data: Comply with requirements specified in Section 01 78 23.

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding

1. Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on the testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.

2. Date of evaluation.

3. Time period when report is in effect.

4. Product and manufacturers' names.

5. Description of product.

6. Test procedures and results.

7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If specified criteria are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 – EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00.

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Partial submittals prepared for a portion of the work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for re-submittal without review.

D. Submittals not required by the Contract Documents may be returned by the Architect without action.

E. Submittals requiring review by authorities having jurisdiction shall be made to the Architect for initial review prior to being submitted to the appropriate authority.

END OF SECTION

SECTION 01 35 91

EXTERIOR BUILDING RESTORATION AND CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for building restoration and cleaning work, including the following:

1. Cleaning exterior concrete and stone masonry surfaces.

2. Re-pointing and/or repair of mortar joints.

3. Repair of existing steel doors and windows.

4. Repair of existing metal railings and handrails.

5. Repair of existing stone masonry.

6. Graffiti removal.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data for each product specified, including recommendations for application and use. Include test reports and certifications substantiating product compliance with Specifications.

C. Cleaning and Restoration Program: Written program for each phase of cleaning and restoration including protection of surrounding materials and site during work.

1. Describe materials, methods and equipment to be used for each phase of work.

2. If alternative methods and materials are proposed for phases, furnish written description, including documentation of successful use on other comparable Projects.

D. Schedule of existing steel windows and doors documenting the existing condition and proposed extent of repairs for each window and door unit.

E. Samples: Furnish the following for verification purposes prior to mock-up erection:

1. Mortar for pointing and rebuilding and repair, 6-inch long, 1/2-inch wide strip of mortar set in aluminum or plastic channel. Include sample for each type and color proposed. Samples shall be produced using all ingredients in proportions to be used in the mortar.

1.03 QUALITY ASSURANCE

A. Cleaning and restoration materials and methods shall be confirmed with Owner’s Representative prior to beginning work.

B. Restoration Specialist: Firm having minimum 5-years experience in comparable historic restoration Projects, employing personnel skilled in the restoration and operations specified.

C. Re-pointing mason shall have a minimum of 5-years experience with re-pointing historic masonry buildings.

D. Field Constructed Mock-Up: Prior to start of work, prepare the following panels on building where directed by the Architect. Obtain Architect's approval of visual qualities before proceeding with the work.

1. Cleaning: Demonstrate materials and methods to be used for cleaning each type of building surface on a 10-sq. ft. area.

2. Re-pointing: Use the same techniques to be used on the Project. Several locations may be required to include all types of masonry, joint styles, mortar colors, and other issues to be encountered on the Project.

3. Graffiti-removal: Prepare sample areas to determine composition of graffiti and effective methods for removal. Comply with specified requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in manufacturer's original and unopened containers and packaging, bearing labels indicating type and names of products and manufacturers.

C. Protect materials during storage and construction from wetting by rain or ground water, and from staining or intermixture with earth and other types of materials.

D. Protect grout, mortar and other materials from deterioration by moisture and temperature.

1. Store in a dry location or in waterproof containers.

2. Keep containers tightly closed and away from open flames.

3. Comply with manufacturer's recommendations for storage temperature requirements.

1.05 PROJECT CONDITIONS

A. Protect persons, motor vehicles, surrounding surfaces, building site, and surrounding buildings from damage resulting from the work.

B. Clean building surfaces when the air temperature is at least 40-deg. F. during and for 7-days after completion of cleaning.

C. Re-point mortar joints or repair masonry when air temperature is between 40- and 80-deg. F. Re-pointing shall be done in the shade, away from strong sunlight to slow the drying process.

D. Prevent grout and mortar from staining face of surrounding surfaces. Remove grout and mortar immediately from exposed masonry and other surfaces.

E. Protect sills, ledges and projections from mortar droppings.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Re-pointing Mortar: Comply with ASTM C270, proportion(s) as determined from analysis of historic mortar.

1. Sand: Free of impurities such as salts or clay, with a rounded particle shape. Gradation shall comply with ASTM C144. Some variation may be acceptable to match the original size and gradation. Sand color and texture shall match the original as closely as possible to provide the proper color match without other additives. Obtain sand from several sources and combine or screen if required to match the range of colors and grain sizes in the historic mortar.

2. Lime: ASTM C207, Type S or Type SA.

3. Lime Putty: ASTM C5.

4. Portland Cement: ASTM C150. Provide white, non-staining portland cement if required for color match of historic mortar. Cement shall not have more than 0.60-percent alkali to help avoid efflorescence.

5. Masonry Cement: Not permitted.

6. Water: Potable; clean and free from acids, alkalis, or other dissolved organic materials.

7. Do not use antifreeze compounds or bonding agents.

8. New mortar shall match the un-weathered historic mortar. Make mortar samples and allow to cure at a temperature of approximately 70-degrees F. for one week and compare to historic mortar.

B. Other Mortar:

1. Portland Cement: ASTM C150, Type I.

a. Where required for mortar color, provide non-staining white cement complying with staining requirements of ASTM C91 for not more than 0.03-percent water soluble alkali.

2. Hydrated Lime: ASTM C207, Type S.

3. Aggregate for Mortar: ASTM C144.

a. Colored Mortar Aggregate: Natural or manufactured sand selected to produce mortar color indicated.

b. Match size, texture and gradation of existing mortar as closely as possible.

4. Colored Mortar Pigment: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes.

5. Water: Clean, free of oils, acids, alkalis and organic matter.

C. Aggregate for Grout: ASTM C404.

2.02 CLEANING MATERIALS AND EQUIPMENT

A. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.

B. Brushes: Fiber bristles.

C. Chemical Cleaning Materials: Prosoco “1922 Hard Surface Cleaner”, “Enviro Klean Degreaser” or approved equal.

D. Spray Equipment: Equipment for controlled spray application of water at specified pressures, measured at spray tip.

1. Water: Fan-shaped spray tip which disperses water at an angle of not less than 15-degrees.

2. Heated Water: Equipment capable of maintaining temperature between 140- and 180-deg. F. at flow rates specified.

3. Steam: Steam generator capable of delivering live steam at nozzle head.

2.03 MORTAR MIXES

A. General:

1. Measurement and Mixing: Measure in a dry condition by volume or equivalent weight. Mix materials in a clean mechanical batch mixer.

2. Pointing Mortar:

a. Mix the ingredients together before adding water.

b. Mix again, adding only enough water to produce a damp, unworkable mix which will retain its form when pressed into a ball.

c. Maintain mortar in dampened condition for 1- to 2-hours.

d. Add remaining water in small portions until mortar of desired consistency is reached.

e. Use mortar within 30-minutes of final mixing; do not re-temper or use partially hardened material.

3. Colored Mortar: Produce color required by use of selected ingredients. Do not adjust proportions without the Architect’s approval. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.

4. Do not use admixtures.

B. Mortar Proportions:

1. Rebuilding Mortar: Comply with ASTM C270, Proportion Specification, Type N, with cementitious material content limited to portland cement-lime.

C. Grout: ASTM C476.

2.04 STONE

A. Where replacement stone is required, provide new stone matching the material, size, shape, color, and texture of existing stone.

PART 3 - EXECUTION

3.01 CLEANING EXISTING EXTERIOR BUILDING SURFACES

A. General: Comply with National Park Service Preservation Brief 1 – Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings https://www.nps.gov/tps/how-to-preserve/briefs/1-cleaning-water-repellent.htm.

B. Determine the general nature and source of dirt to remove it in the most effective and least harmful manner.

C. Cleaning methods include water, chemical and mechanical (abrasive). To determine the cleaning method(s) to be used, the following conditions shall be considered:

1. Environmental Concerns: The potential effect of each proposed cleaning method shall be evaluated. The proposed cleaning method and materials may cause damage to landscaping, animal life, and property.

2. Personal Safety.

D. Test Cleaning Methods: Several cleaning methods shall be tested prior to selection to determine the one most effective.

E. Level of Desired Cleanliness: Determine the desired appearance prior to selection of the cleaning method to be used.

F. Perform cleaning tests on an area of sufficient size to give a true indication of effectiveness. The test area shall include each material required to be cleaned. More than one cleaning method may be required to achieve the required results.

G. Water Cleaning: Cleaning methods include low pressure wash over an extended period, moderate to high pressure wash and steam. Bristle brushes may be used to supplement the water wash. Joints, including mortar and sealant, shall be sound to minimize water penetration. Water methods shall not be used during periods of cold weather and no water cleaning shall be done for several days prior to the first average frost date.

H. Chemical Cleaning: Before use, verify that surfaces are not subject to direct attack by cleaning chemicals and that a change in the surface color and appearance doesn't occur from the chemical cleaners.

I. Mechanical Cleaning: Methods include grit blasters, grinders, and sanding discs to abrade the dirt from the surface. Do not use mechanical cleaning methods on brick, soft stone, detailed carvings, polishes surfaces or mortar joints.

3.02 REPOINTING MORTAR JOINTS

A. Provide a unit price per lineal foot for re-pointing each type of masonry.

B. General: Comply with National Park Service Preservation Brief 2 – Repointing Mortar Joints in Historic Masonry Buildings https://www.nps.gov/tps/how-to-preserve/briefs/2-repoint-mortar-joints.htm

C. Re-pointing is the process of removing deteriorated mortar from the joints and replacing it with new mortar.

D. Preliminary research is required to ensure that re-pointing work is both physically and visually appropriate to the building. Analysis of un-weathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the re-pointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable.

E. A mortar analysis by a qualified laboratory may be used to provide information on the original mortar ingredients. Analysis includes original water content, rate of curing, weather conditions during original construction, method of mixing and placing, cleanliness and condition of the sand, and identification of sand by gradation and color.

1. Mortar samples shall be chosen carefully and picked from a variety of locations on the building to find un-weathered mortar.

F. New mortar shall conform to the following:

1. Shall match the historic mortar in color, texture, and tooling.

2. Sand shall match the sand in the historic mortar.

3. Shall have greater vapor permeability and be softer (measured in compressive strength) than the masonry units.

4. Shall be as vapor permeable and as soft or softer (measured in compressive strength) than the historic mortar.

G. Extent: Re-point only those areas where mortar is severely disintegrated, as directed by the Architect.

H. Joint Preparation:

1. Old mortar shall be removed to a minimum depth of 2- to 2-1/2-times the width of the joint to ensure adequate bond and to prevent mortar pop outs. Remove loose or disintegrated mortar beyond this minimum depth.

2. Remove mortar cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints shall be rinsed with a jet of water to remove loose particles and dust. At time of filling, joints shall be damp but with no standing water.

I. Joint Filling:

1. Where existing mortar has been removed to a depth greater than 1-inch, the areas shall be filled first, compacting the new mortar in several layers approximately 1/4-inch thick, packing it well into the back corners. As soon as the mortar has reached thumb-print hardness, another 1/4-inch layer may be applied. Allow each layer time to harden before the next layer is applied.

2. When the final is thumb print hard, the joint shall be tooled to match the historic joint. Observe the horizontal and vertical joints in the historic mortar to determine the order in which they were tooled and whether they were the same style.

3. After tooling, remove excess mortar from the edge of the joint by brushing with a natural bristle or nylon brush. Do not use metal bristle brushes.

J. Curing: Periodically wet re-pointed areas after the mortar joints are thumb print hard and have been finish tooled. Continue curing as required by local conditions. Cover walls with burlap for the first 3-days after re-pointing. Plastic may be used but shall not be allowed to contact the wall.

K. Cleaning: Remove small amount of mortar from the edge of the joint following tooling using a stiff natural bristle or nylon brush after the mortar has dried but before it is initially set. If the mortar has hardened, remove with a wooden paddle. If required, very low pressure (100-psi) water washing supplemented by stiff natural bristle or nylon brushes may be used. Do not clean until the mortar has fully hardened.

3.03 REPAIR OF HISTORIC STEEL DOORS

A. Determine metallic storefront composition.

B. Deteriorated metal elements may be repaired by a variety of means.

1. Patches may be used to mend, cover or fill a deteriorated area. Patches shall be a close match to the original material to prevent galvanic corrosion.

2. Splicing shall be undertaken on structural members only when temporary bracing has been constructed to carry the load.

3. Reinforcing or bracing the damaged element with additional new material can relieve fatigue or overloading.

4. If metal components have deteriorated to a point where they have failed or are missing, replacement is the only reasonable course of action.

C. Cleaning and Painting:

1. Steel storefronts may be encrusted with layers of paint. Where paint buildup and rust are not severe problems, hand scraping and wire brushing are viable cleaning methods. For situations involving extensive paint build up and corrosion, mechanical methods such as low pressure gentle dry grit blasting may be used to provide a good surface for the paint. Protect adjacent surfaces against damage from blasting. Re-seal and putty the heads of screws and bolts after grit blasting to prevent moisture from entering the joints. Cleaned areas shall be painted immediately after cleaning with a rust-inhibiting primer.

2. Storefronts utilizing softer metals, sheet metals and plated metals shall not be cleaned mechanically. Clean with a chemical method. Once the surface is cleaned of corrosion, grease, and dirt, a rust-inhibiting primer shall be applied.

3.04 REPAIR OF HISTORIC STEEL WINDOWS

A. General: Comply with National Park Service Preservation Brief 13 – The Repair and Thermal Upgrading of Historic Steel Windows https://www.nps.gov/tps/how-to-preserve/briefs/13-steel-windows.htm

B. Physical Evaluation: Carefully examine the physical condition of existing aluminum or steel windows on a unit-by-unit basis. Prepare a graphic, photographic or window schedule to record existing conditions and document the scope of any necessary repairs. Document presence and degree of corrosion, condition of paint, deterioration of the metal sections including bowing, misalignment of the sash, or bent sections, condition of the glass and glazing compound, presence and condition of hardware, screws, bolts, and hinges, and condition of the surrounds, including need for sealants or resetting improperly sloped sills. Submit for approval prior to beginning repair of steel windows.

C. Corrosion: Corrosion may be light, medium or heavy; depending on how much the rust has penetrated the metal sections. If the rusting is merely a surface accumulation or flaking, the corrosion is light. If the rusting has penetrated the metal as indicated by a bubbling texture but has not caused structural damage, the corrosion is medium. If the rust has penetrated deep into the metal, the corrosion is heavy. A sharp probe or tool can be used to determine the extent of metal corrosion. If the probe can penetrate the surface of the metal and brittle strands can be dug out, then a high degree of corrosive deterioration is present.

D. Routine Maintenance:

1. Remove surface dirt and grease to ascertain the degree of deterioration. Minor cleaning may be accomplished using a brush or vacuum followed by wiping with a cloth dampened with mineral spirits or denatured alcohol.

2. If windows are determined to be in a sound condition, take the following steps:

a. Remove light rust, flaking and excessive paint. Rust removal methods include manual and mechanical abrasion or the application of chemicals. Rust can be removed using a wire brush, aluminum oxide sandpaper, or a variety of power tools adapted for abrasive cleaning such as an electric drill with a wire brush or a rotary ship attachment. Protect adjacent sills and window jambs. Remove rust using a commercially prepared anti-corrosive acid compound. Protect adjacent masonry surrounds from contact with acid cleaners. Remove remaining loose or flaking paint with a chemical paint remover or with a pneumatic needle scaler or gun.

b. Wipe bare metal with a cleaning solvent such as denatured alcohol and immediately dry in preparation for priming. Prime exposed metal with a rust-inhibiting primer immediately after cleaning.

c. Replace cracked or broken glass and glazing compound. When bedding glass, use glazing compound formulated for metal windows.

d. Replace missing screws or fasteners.

e. Clean and lubricate hinges. Clean with cleaning solvent and fine bronze wool. Lubricate with a non-greasy lubricant formulated for metals and with an anti-corrosive agent.

f. Repaint metal sections with two coats of finish paint compatible with the primer. Comply with the requirements of Section 09 91 00.

g. Seal masonry surrounds with elastomeric sealant. Comply with the requirements of Section 07 92 00.

E. In-place Repair:

1. Comply with specified requirements for routine maintenance above.

2. Medium to heavy corrosion that has not done structural damage can be removed by using the chemical cleaning process or by sandblasting using low pressure and a grit size in the range of #10 to #45. Provide metal or plywood shields to protect masonry surrounds and glass.

3. Bare metal shall be primed as soon as possible after exposure to the air.

4. Bent or bowed metal sections may be realigned without removing the window.

5. Once metal sections have been cleaned of corrosion and straightened, small holes and uneven areas resulting from rusting shall be filled with a patching material and sanded smooth to eliminate pockets where water can accumulate.

6. Replace cracked glass, deteriorated glazing compound, missing screws, and broken fasteners. When bedding glass, use glazing compound formulated for metal windows.

7. Clean and lubricate hinges. Clean with cleaning solvent and fine bronze wool. Lubricate with a non-greasy lubricant formulated for metals and with an anti-corrosive agent.

8. Repair existing window operators. Where repair is not possible, replace with new operators to match the function and appearance of the existing operators as approved by the Architect.

9. Repaint steel sections with two coats of finish paint compatible with the primer. Comply with requirements of Section 09 91 00.

10. Seal masonry surrounds with elastomeric sealant. Comply with the requirements of Section 07 92 00.

F. Where new steel windows are required to match existing historic windows, comply with Section 08 51 26,

3.05 REPAIR OF HISTORIC CONCRETE

A. General: Comply with National Park Service Preservation Brief 15 – Preservation of Historic Concrete https://www.nps.gov/tps/how-to-preserve/briefs/15-concrete.htm

B. Signs of Concrete Deterioration: Cracks, either active or dormant.

C. Concrete Repair: Repair may consist of either patching the historic material or filling in with new material worked to match the historic material. If replacement is required, duplication of historic materials and detailing shall be as exact as possible to assure a repair that is functionally and aesthetically acceptable.

D. Repair of Dormant Cracks:

1. Hairline, non-structural cracks that show no sign of worsening normally need not be repaired.

2. Cracks larger than hairline cracks but less than approximately 1/16-inch may be repaired with a mix of cement and water.

3. Cracks wider than 1/16-inch shall have sand added to the mix to allow for greater compaction and to reduce shrinkage during drying.

4. Perform field trials to determine if cracks need to be routed (widened and deepened) before patching to allow sufficient penetration of the patching material.

5. Patching materials shall be selected to be compatible with the existing concrete and subsequent surface treatments.

E. Repair of Active Cracks: Fill with sealants that will adhere to the sides of the cracks and that will compress or expand during crack movement.

F. Repair of Spalling: Remove loose, deteriorated concrete and install a compatible patch that dovetails into the existing sound concrete.

1. Once deteriorated concrete in the spalled area has been removed, rust on the exposed reinforcing bars shall be removed by wire brush or sandblasting. Immediately apply an epoxy coating to reduce future corrosion.

2. If a large, clean break or other smooth surface is to be patched, the contact area shall be roughened with a hammer and chisel.

3. Maintain the substrate in a moist condition using wet rags, sponges or running water for at least one hour before placement of the patch.

4. Improve bonding between the patch and substrate by scrubbing the substrate with cement paste or apply a liquid bonding agent. The use of epoxy resin, latex, or acrylic admixtures to increase bonding may be used.

5. Repair material shall match the composition of the original material as revealed by laboratory analysis as closely as possible. Match the color and texture of the existing concrete. Mix several test batches of patching material by adding mineral pigments that vary slightly in color. After samples are cured, compare to the historic concrete to determine the closest match.

6. Where patch sizes permit, provide stainless steel hooked pins placed in holes drilled into the structure and secure pins in place with epoxy.

7. Compact patching material.

8. If patches require forming, remove forms before the patch has fully set and finish the patch surface to match the historic concrete using a brush or wet sponge to achieve required textures. Holes from form ties or bolts shall be patched and finished to match adjacent surfaces.

9. Cure patch by keeping it wet for several days with damp burlap bags.

G. Repair of Erosion: Repair eroded concrete by replacing lost surface material with a compatible patching material. Apply an appropriate finish to match the historic appearance. If required, install drip grooves at the underside of overhanging edges of sills, belt courses, and projecting slabs.

3.06 REMOVAL OF GRAFFITI FROM HISTORIC SURFACES

A. General: Comply with National Park Service Preservation Brief 38 – Removing Graffiti from Historic Masonry https://www.nps.gov/tps/how-to-preserve/briefs/38-remove-graffiti.htm

B. Successful graffiti removal from historic masonry depends on achieving a balance between breaking the bond between the graffiti and the masonry surface without damaging the masonry. This requires knowledge of the materials used to make the graffiti and the masonry on which the graffiti was applied.

C. For purposes of this Section, masonry encompasses all types of natural stones; manufactured clay materials, including brick and terra cotta; and cementitious materials, such as cast stone, concrete and mortar.

1. For purposes of cleaning, masonry types are categorized according to whether they are acid-sensitive, non-acid sensitive, or alkali-sensitive.

a. Acid-Sensitive stones may be damaged or destroyed by contact with acids. Acid-sensitive materials include limestone, marble, travertine, calcareous sandstones and shales, polished stones, and glazed architectural terra cotta and glazed brick.

b. Non-acid sensitive masonry materials include slate, granite, unglazed architectural terra cotta and unglazed brick.

c. Alkali-sensitive stones contain silicates or ferrous, soluble iron compounds that can react with alkalis or water to form staining. Alkali-sensitive stones include some granite, Indiana limestone, and many types of sandstone.

D. Testing: Before selecting a removal method, all cleaning materials and techniques for removing graffiti from a historic masonry building shall be tested on mock-ups or areas of the building that are not highly visible, but which are representative of typical conditions. Visual observation shall be supplemented using a magnifying glass and spot tests shall be carried out with various solvents to help identify the specific graffiti medium. More complex testing using laboratory equipment and more scientific analytical processes may be required in complex situations. Sample areas that represent the desired degree of cleanliness shall be approved in writing by the Architect. The materials and other data necessary to reproduce the desired cleaning results shall be recorded and the accepted sample area preserved for reference until the end of the Project.

E. Graffiti Removal Materials and Methods:

1. General: A variety of treatments are available from which to choose the most appropriate method of graffiti removal that will not damage the surface of historic masonry. Successful graffiti removal often requires a combination of cleaning materials and methods.

2. Poulticing: A poultice consists of an absorbent material or powder-inert clays, diatomaceous earth or cellulose products such as fluff pulp cellulose or shredded paper-mixed with a cleaning solution to form a past or slurry. The poultice enables a cleaning solution to be kept in contact with the stained area as long as possible while allowing the cleaning solution to pull the staining material out of the substrate via the poultice without re-depositing it in, or re-staining, the masonry. A poultice is often covered with a plastic sheet to retard evaporation.

3. Water and Detergent: Graffiti removal from historic masonry should always begin with the gentlest means possible. Fresh graffiti made with water-soluble markers may sometimes be removed with water, possibly aided by a neutral or non-ionic detergent. Ammonia can also be used in removing fresh graffiti. Any detergent shall be approached with caution and tested before using since many detergents are not neutral and contain substances that may leave undesirable residues on masonry materials. The water and detergent shall be mixed with an absorbent material and applied in the form of a poultice.

4. Organic Solvents and Paint Removers: Most graffiti can be removed without damaging the masonry with proprietary graffiti-removal products and commercial paint strippers containing organic solvents. These products should be tested and used in accordance with the manufacturer's instructions. Solvents shall be used in a poultice form to prevent them from penetrating into the substrate and permanently discoloring or staining the masonry. Comply with Material Safety Data Sheets (MSDS).

5. Alkaline Compounds: Alkaline compounds may be used to remove some oils and grease, and waxes from non-alkali sensitive masonry. Alkaline compounds shall be used in conjunction with a poultice when removing graffiti. The use of alkaline compounds shall be followed by a weak acid wash and a water rinse to neutralize or remove the alkaline residues from the masonry. Do not use strong alkalines (pH 13-14) since they can cause efflorescence and staining on masonry surfaces if not properly neutralized.

6. Bleaches: Alkali-based bleaches such as calcium hypochlorite can be used in a poultice to bleach or decolorize certain dyes contained in some paints and inks that cannot readily be removed by other means.

7. Mechanical or Abrasive Methods: Mechanical treatments include dry or wet blasting using abrasive grits; high-pressure water washing; and mechanical sanding or grinding. Abrasive methods will cause damage to masonry and should not be considered as a method of removing graffiti from historic masonry. Under very controlled circumstances, a micro-abrasive technique may be appropriate for removing graffiti from delicate masonry surfaces if used at low pressures of 35- to 40-psi with fine abrasives. This treatment shall be done very slowly and carefully to avoid damaging the masonry and shall be tested first and performed only by a professional conservator.

F. Graffiti-Removal Techniques and Guidelines:

1. Carry out graffiti removal in well-ventilated conditions. Workers shall wear protective clothing and personal protective equipment as recommended by graffiti removal material manufacturer.

2. Pre-wet the masonry when using an alkaline paint remover. Pre-wet the surrounding surfaces to dilute the effect on any cleaning agents that might be inadvertently splashed or spilled on the surface. Do not wet the area to be cleaned if the cleaning agent is solvent-based or incompatible with water.

3. Rinse the cleaning agent off the masonry surface starting at the bottom and moving up to prevent the cleaning agent from running down and staining a lower surface.

4. Mortar joints react differently from masonry units and may require a different cleaning material and/or method.

5. Graffiti removal may result in an obviously clean spot. Clean the entire masonry unit that is bounded by mortar joints but not the joints themselves unless necessary. The prominence of the clean spot may be minimized by fanning the cleaning out from the spot and feathering it by gradually reducing the strength or thoroughness of the cleaning.

6. If it is not possible to completely remove all traces of graffiti without removing some of the masonry surface, it may be preferable to leave the masonry alone. Some graffiti ghosts become less noticeable with time due to fading of the dyes used in paints and markers. It may be possible to conceal more obvious graffiti ghosts with carefully matched paint.

7. After graffiti removal, the masonry surface shall be tested with pH strips to make sure all cleaning materials have been removed. Non-staining pH strips will indicate whether acids or alkalis remain on the masonry surface.

8. Although alkaline paint removers are sometimes ineffective on modern formulations of aerosol paints, they may work well in removing multi-layered graffiti because they last longer.

9. What removes graffiti in one instance may not always work again even in what appears to be an identical situation.

10. More than one cleaning material and technique may be required to clean a heavily graffitied area if different materials were used to make the graffiti.

11. Effective graffiti removal often depends on trial-and-error testing as well as knowledge of masonry materials, graffiti materials and cleaning techniques.

END OF SECTION

SECTION 01 35 92

INTERIOR RESTORATION AND REPAIR PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for interior building restoration and repair work procedures, including the following:

1. Storage and protection of existing historic materials.

2. Temporary protection of historic materials during construction.

3. Repair of existing interior plaster.

4. Repair of existing interior wood millwork.

5. Painting historic interiors.

B. Related Sections:

1. Exterior building restoration and cleaning is specified in Section 01 35 91.

1.02 DEFINITIONS

A. "Preservation": To apply measures necessary to sustain the existing form, integrity, and materials of a historic property. Work may include preliminary measures to protect and stabilize the property.

B. "Rehabilitation": To make possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.

C. "Restoration": To accurately depict the form, features, and character of a property as it appeared at a particular period by means of the removal of features from other periods in its history and the reconstruction of missing features from the restoration period.

D. "Reconstruction": To reproduce in the exact form and detail a building, structure, or artifact as it appeared at a specific period.

E. "Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form, as it exists at present.

F. "Protect and Maintain": To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.

G. "Repair": To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.

H. "Replace": To duplicate and replace entire features with new material in kind. Replacement includes the following conditions:

1. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.

2. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.

3. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.

I. "Remove": To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

J. "Remove and Salvage": To detach items from existing construction, catalog items, and deliver them to Owner ready for reuse.

K. "Remove and Reinstall" or “Remove for Reinstallation”: To detach items from existing construction, catalog items, prepare them for reuse, and reinstall them where indicated.

L. "Existing to Remain" or "Retain": Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.

M. "Material in Kind": Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data for each product specified, including recommendations for application and use. Include test reports and certifications substantiating product compliance with Specifications.

C. Historic Treatment Program: Submit a written plan for each phase or process including protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work.

D. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.

E. Qualification Data: Statement of qualification data for firms and persons. Include list of completed projects with project name and address, architect name and address, owner name and address, the scope of work and budget for each.

F. Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by historic treatment operations. Submit before work begins.

G. Samples for Verification of the Following:

1. Lumber and panel products with non-shop-applied transparent or opaque finishes, 50-sq. in for lumber and 8- x 10-inches for panels for each species and cut, with one-half of exposed surface finished as required.

2. Lumber and panel products with shop-applied transparent and opaque finishes, 50-sq. in. for lumber and 8- x 10-inches for panels for each finish system and color.

1.04 QUALITY ASSURANCE

A. Cleaning and restoration materials and methods shall be confirmed with the Architect prior to beginning work.

B. Restoration Specialist: Firm having minimum 5-years' experience in comparable historic restoration Projects, employing personnel skilled in the restoration and operations specified.

C. Historical Accuracy: Visible building elements, including plain and ornamental features, materials, and methods of fabrication and construction shall match as closely as possible the original elements of the building. The work of this Project shall match in quality, style, and detail the existing and original details to the approval of the Architect.

D. Mock-up: Construct a mock-up using methods and materials proposed to refinish existing plaster wall and ceiling surfaces in Office areas. Mock-up shall include wire-brushing, cleaning, and clear sealing. Approved mock-up shall serve as the standard of quality required and if approved by the Architect, may be incorporated into the Work.

1.05 STORAGE AND PROTECTION OF HISTORIC MATERIALS

A. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted by Architect, items may be removed to a suitable, protected storage location during historic treatment and cleaned and reinstalled in their original locations after historic treatment operations are complete.

B. Storage and Protection: When removed from their existing location, store historic materials within a weathertight enclosure where they are protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.

1. Identify removed items with an inconspicuous mark indicating their original location.

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in manufacturer's original and unopened containers and packaging, bearing labels indicating type and names of products and manufacturers.

C. Protect materials during storage and construction from wetting by rain or ground water, and from staining or intermixture with earth and other types of materials.

D. Protect materials from deterioration by moisture and temperature.

1. Store in a dry location or in waterproof containers.

2. Keep containers tightly closed and away from open flames.

3. Comply with manufacturer's recommendations for storage temperature requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Products shall be as required to perform the work.

PART 3 - EXECUTION

3.01 PROTECTION OF HISTORIC ELEMENTS AND MATERIALS

A. Install protection before commencement of work that may harm historic elements.

B. Protect historic elements to remain in place during construction that may be damaged by construction activities. In the event of damage, notify the Architect as to the nature and extent of damage and the proposed method for repair. The Contractor shall be responsible for repairs and replacement of newly damaged items to the satisfaction of the Architect, at no additional cost to the Owner. Be aware that the inherent value of an historic original element is higher than the value of a modern replication of that element.

C. Do not attach protection materials directly to historic elements.

D. Secure protection adequately to maintain a safe environment for workers and other individuals using the building throughout the duration of the Project.

E. Protection may be required to remain in place for the duration of the Project. Protection may have to be removed for access to protected elements, etc. If protection is temporarily removed, reinstall after work is complete and maintain protection throughout the duration of the Project.

F. Extent of protection includes historic elements that will remain during construction, whether specifically indicated on the Drawings. Temporary protection may be required in areas to perform specific work activities.

G. Protection assemblies shall be self-supporting and self-bracing. Protection assemblies may be secured to floor protection if fasteners do not penetrate through the plywood layer.

H. Materials and/or elements that require protection from construction activities:

1. Wood and plaster walls and ceilings.

2. Original light fixtures.

3. Original doors and windows.

3.02 GENERAL REQUIREMENTS FOR TREATMENT PROCEDURES FOR HISTORIC ELEMENTS AND MATERIALS

A. The principal aim of preservation work is to halt the process of deterioration and stabilize the item's condition, unless otherwise indicated. Repair is required where specifically indicated. The following procedures shall be followed:

1. Retain as much existing material as possible; repair and consolidate rather than replace.

2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.

3. Use reversible processes wherever possible.

4. Use traditional replacement materials and techniques. New work shall be distinguishable to the trained eye, on close inspection, from old work.

5. Record the work before the procedure with preconstruction photos and during the work with periodic construction photos.

B. Obtain Architect's review and written approval in the form of a Field Order or Supplemental Instruction before making changes or additions to construction or removing historic materials.

C. Notify Architect of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, or due to structural defects including cracks, movement, or distortion. Do not proceed with the work in question until directed by Architect.

D. Where Work requires existing features to be removed and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.

E. Identify new or replacement materials and features with inconspicuous, permanent marks to distinguish them from original materials. Record the legend of identification marks and the locations of these marks on Record Drawings.

F. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid over-cleaning to prevent damage to existing materials during cleaning.

H. Where Work requires existing features to be removed and salvaged:

1. Disassemble, label, catalog, handle, transport and store historic elements which have been identified for removal. Contractor is responsible for handling, transporting and storage of the items in the storage area.

2. Catalog salvage elements that have been removed on an artifact log. Document element type, unique number, size, configuration, quantity, condition, original location, disposition and location in storage.

3. Store salvage elements in a neat, orderly fashion to allow for access and retrieval. Store like type elements together in groups. Store particularly fragile elements in a manner to prevent damage while in storage.

3.03 REPAIR OF INTERIOR PLASTER

A. General: Comply with National Park Service Preservation Brief 21 – Repairing Historic Flat Plaster Walls and Ceilings https://www.nps.gov/tps/how-to-preserve/briefs/21-flat-plaster.htm

B. Filling Cracks:

1. Hairline cracks in walls and ceiling plaster are not a serious cause for concern if the underlying plaster is in good condition. Fill hairline cracks with a patching material as specified.

2. For cracks that reopen with temperature and humidity changes, the crack shall be widened with a sharp, pointed tool and then filled.

3. For persistent cracks, bridge the crack with fiberglass mesh tape pressed into the patching material. After the first application of a quick setting joint compound dries, a second coat shall cover the tape, feathering at the edges. Apply a third coat to even out the surface and follow by a light sanding.

4. Large cracks due to structural movement shall be repaired after repairs to the structural system have been made. The plaster on each side of the crack shall be removed to a width of approximately 6-inches down to the lath. Clean out debris and apply metal lath to the cleaned area leaving the existing wood lath in place. Patch the crack with an appropriate plaster in three layers.

C. Replacing Delaminated Areas of the Finish Coat: Paint a liquid plaster bonding agent on the areas of basecoat plaster that will be re-plastered with a new lime finish coat.

D. Patching Holes in Walls:

1. Repair small holes less than 4-inches in diameter in two applications. Trowel-apply a layer of base coat plaster and scrape back below the level of the existing plaster. When the base coat has set but before it dries, apply more plaster to create a smooth, level surface.

2. For larger holes where three coats of plaster are damaged or missing down to the wood lath, remove the old plaster and re-nail any loose lath. Spray a water mist on the old lath to keep it from twisting when the new, wet plaster is applied or apply a liquid bonding agent. Attach expanded metal lath to the wood lath with tie wires or with lath nails. Apply plaster in 3 layers lapping each new layer over the old plaster so that old and new are evenly joined.

3. If a patch is made in a plaster wall that is slightly wavy, the contour of the patch shall conform to the irregularities of the existing work.

E. Patching Holes in Ceilings: Examine the plaster around the loose plaster. If the surrounding areas are in reasonably good condition, the loose plaster can be re-attached to the lath using flathead wood screws and plaster washers. To patch a hole in the ceiling plaster, fasten metal lath over the wood lath and fill the hole with successive layers of plaster.

F. Establishing New Plaster Keys:

1. If the back of the ceiling lath is accessible, small areas of bowed out plaster can be pushed back against the lath.

2. After dampening the old lath and coating the damaged area with a bonding agent, a liquid plaster mix with glue size retardant added shall be applied to the backs of the lath and worked into the voids between the faces of the lath and the back of the plaster. While the first layer is still damp, plaster-soaked strips of jute scrim shall be laid across the backs of the lath and pressed firmly into the first layer as reinforcement.

3. Loose, damaged plaster can also be re-keyed when the goal is to conserve decorative surfaces or wallpaper.

G. Re-plastering over Existing Surfaces:

1. If a historic surface is too cracked to patch or is sagging, maintain the old surface and re-plaster over it.

2. Cover the existing surface with 1x3 wood furring strips, one to each joist and fasten completely through the old lath and plaster using a screw gun.

3. Attach expanded metal lath or gypsum lath over the furring strips.

4. Apply two or three coats of plaster according to traditional plaster application methods.

H. At office spaces, existing plaster and paint shall be wire-brushed, cleaned, and clear-sealed to match approved mock-up.

H. Plaster Patching Materials: Plaster shall be determined by the plasterer.

3.04 PAINTING HISTORIC INTERIORS

A. General: Comply with National Park Service Preservation Brief 28 – Painting Historic Interiors https://www.nps.gov/tps/how-to-preserve/briefs/28-painting-interiors.htm

B. Surface Preparation:

1. Scraping and Sanding: Remove loose paint from sound surfaces. Utilize careful hand scraping and hand sanding to feather the edges of the firmly adhering layers down to the bare areas to avoid shadow lines. Where required for paint adhesion, lightly roughen the existing paint providing a “tooth” for the primer and new paint.

2. Paint Removal: Remove existing paint when loose or extensively damaged.

a. If existing paint is lead based, take necessary precautions to mitigate the hazards of lead paint injection, inhalation, or contact. Prevent dust from circulating by means of masking room openings and removing curtains, carpeting, and upholstered furniture. Drop cloths and masking containing lead dust shall be enclosed in tight plastic bags before removal. Workers in the room shall wear High Efficiency Particulate Air (HEPA) filters for lead dust, change clothing just outside the room leaving the work clothes inside, and avoi8d contact between bare skin and the paint being removed. Do not eat or drink where lead dust is present. After lead-based paint has been removed, the surfaces of the room shall be given a final wash with a solution of trisodium phosphate and water, changing the washing solution often.

b. Remove using chemical or solvent stripping. Remove alkaline residues by neutralizing with an acidic wash of white vinegar.

c. Remove water-based paints with a solution of detergent and hot water.

d. If effective, air pressure of 200- to 500-psi may be used to remove loose paint on flat surfaces if there is a weak surface bond.

3. Patching and Repair: Once the substrate is sound and clean, free from crumbling, loose material or dust, undercut and fill cracks with appropriate filler.

4. Priming: Apply primer recommended by paint manufacturer for substrates to be repainted. If latex primers are used, verify they are compatible over existing oil or oil/alkyd paint. Primer shall be by the same manufacturer as the subsequently applied finish coats.

5. Finish Coats: Apply by brush or roller in accordance with manufacturer's recommendations. Comply with the additional requirements specified in Section 09 91 00.

3.05 INTERIOR FINISH CARPENTRY AND MILLWORK RESTORATION

A. Architectural woodwork for salvage shall be removed from the building before general interior demolition work begins. Woodwork to remain shall be protected by padded protective barriers to resist damage by the work of other trades. Existing architectural woodwork to be removed shall be carefully removed, labeled by schedule number, and padded and crated. Damaged material shall be replaced by the Contractor at no cost to the Owner.

B. Materials:

1. Lumber and finished woodwork shall be of sound stock, seasoned, kiln-dried to a moisture content not exceeding 19-percent for framing and 11-percent for finish.

2. Work to be finished or painted shall be free from defects or blemishes on surfaces exposed to view that will show after the finish coat is applied.

3. Glue: Non-staining waterproof type.

4. Replacement Wood: NAAWS 4.0 Premium grade, free of defects which would impair appearance, strength or durability.

a. Wood for infill repairs shall match existing in species, with color, figure, grain, texture, hardness, and general attributes and appearance to match original.

b. New wood shall match existing being replaced or restored. New wood shall match the original species with color, figure, grain, texture, hardness, and general attributes and appearance to match original.

c. Provide replacement wood members, moldings and dutchmen with dimensions, profiles and details to match originals or existing adjacent work into which new work is being matched and installed.

5. Refinishing Materials:

a. Water: Clean, potable water free of deleterious amounts of oils, acids, alkalis, sediment, rust, salts and organic matter.

b. Wood Grain Filler: Acrylic-based wood grain filler.

c. Tint for Wood Filler: Powdered color pigments.

d. Stain: WATCO "Danish Oil Finish", Minwax or approved equal oil wiping stain composed of colors selected and/or mixed as appropriate to match and blend with existing wood.

e. Finish Coatings: Zinsser, McCloskey or approved equal shellac and/or varnish.

f. Provide fine grade Scotch-Brite pads, very-fine steel wool, and clean, soft, lintless, cotton rags as required.

6. Epoxy Adhesives: Sika or approved equal.

7. Wood Fillers: Abatron, Inc. Woodepox #1 or approved equal low modulus epoxy resin mixed with microballoons.

8. Repair Adhesives: Non-staining, waterproof, aliphatic resin type glue.

9. Fasteners: Nails, screws, and other anchoring devices of type, size, material, and finish as required for application and to provide secure attachment.

C. Fabrication of Woodwork:

1. Work shall comply with NAAWS 4.0 Premium Grade. Repair existing millwork exactly matching existing joinery, profiles and dimensions.

2. Work shall be fabricated to designs, dimensions, and details indicated and shall replicate existing features, construction, profiles and overall appearance.

3. Mill and finish wood accurately to detail, with clean cut moldings, profiles and lines, machined, sanded smooth, housed, jointed, blocked, put together in the best manner. Provide for swelling and shrinkage and to assure integration with the work remaining in place without warping, splitting or opening of joints.

4. Cut panels and trim from solid stock to match fabrication of existing originals. Match dimensions of built-up members. Fabricate trim and moldings in single lengths.

5. Fabricate new woodwork in the shop, complete and/or as large units as practical, leaving only fitting, assembly, installation and a minimum of fabrication and finishing to be performed at the building. Assembled work shall be rigidly secured and permanently fastened together with concealed fasteners.

D. Condition woodwork to average prevailing humidity conditions in installation areas before installation for a minimum 24-hours.

E. Installation:

1. Comply with Premium requirements of NAAWS 4.0.

2. Repair/replace damaged and deteriorated interior wood elements including interior wood paneling, moldings, trim, doors, door surrounds, chair and picture rail, and other wood details. Restore finish on original woodwork to match original finish and sheen.

3. Install woodwork plumb, level, true, and straight with no distortions, aligned with adjacent materials. Use concealed shims where required for alignment.

4. Scribe and cut woodwork to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

5. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.

6. Install to a tolerance of 1/8-inch in 8-feet for plumb and level. Install with no more than 1/16-inch in 8-feet vertical cup or bow and horizontal variation from a true plane. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

7. Millwork and Trim:

   a. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 36-inches long. Stagger joints in adjacent and related trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout lengthy of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints if required.

   b. Match color and grain pattern across joints.

   c. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

8. Paneling:

   a. Arrange in patterns as required to match the original design.

   b. Install in full lengths without end joints.

   c. Install with uniform end joints with only end-matches joints within each field of paneling.

   d. Fasten to substrate by face nailing, setting nails, and filling over nail heads.

9. Wood Doors and Frames:

   a. Remove interior finishes using chemical stripping system capable of being controlled to avoid damage to surrounding surfaces. Do not use heat guns, sanders, or other methods to strip wood which might cause lead compounds to be dispersed. Remove paints in solubilized or plastic state. Do not scrape or sand brittle residues. Remove residues by hand with sponge and water. After paint residues have been removed, rinse and neutralize wood to remove traces of stripping compounds and properly prepare wood for repainting.

   b. Replace missing, deteriorated and rotted wood with new wood members or glued-in-place dutchmen of matching species and appearance. Do not remove existing sound wood except to allow for keying-in of new replacement wood. Removal shall be held to a minimum. Reconstruct damaged and deteriorated moldings, stiles, rails, jambs, stops, parting beads, trim, etc. to match existing original members in all details. Fabricate joinery to match original.

   c. Consolidate and restore weakened wood using low-viscosity, epoxy-based, impregnating liquid by brush to refusal. Restore small missing areas with epoxy-based paste filler/adhesive. Shape and sand to match original proportions, dimensions, profiles and contours. Fill nail holes and similar minor losses with compatible commercial wood filler formulated for use under the conditions in which it is installed.

d. Minor surface defects and cosmetic damage shall be filled, shaped, sanded and refinished. A certain amount of imperfections will be acceptable as existing woodwork may retain a semblance of their age after restoration.

e. Prime wood to receive opaque finish with one coat of penetrating primer. Comply with the requirements specified in Section 09 91 00.

F. Comply with additional requirements specified in Section 06 40 23.

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.01 DEFINITIONS

A. Soils Engineer: A civil engineer, licensed in the State of Arizona retained and paid by the Owner to perform services as specified.

B. Testing Laboratory: An independent commercial testing organization, retained and paid by the Owner to perform tests and report on work as specified and as required.

1.02 SOILS ENGINEER

A. Services of a Soils Engineer are required for work specified in other Sections.

1.03 TESTING LABORATORY

A. General: Services of a Testing Laboratory are required for work specified in other Sections.

B. Contractor's Responsibilities:

1. Cooperate with Testing Laboratory personnel.

2. Secure and deliver to the Testing Laboratory adequate quantities of representational samples of materials proposed for use for which testing is required.

3. Furnish copies of product test reports as required.

4. Furnish incidental labor and facilities:

a. To provide access to work to be tested.

b. To obtain and handle samples at the Project site or at the source of the product to be tested.

c. To facilitate inspections and tests.

d. For storage and curing of test samples.

5. Notify the Architect sufficiently in advance of operations to allow for Testing Laboratory assignment of personnel and scheduling of tests.

a. When tests or inspections cannot be performed after such notice, reimburse the Owner for the Testing Laboratory personnel and travel expenses incurred.

1.04 TEST REPORTS

A. The Testing Laboratory will distribute reports as follows:

1. Architect: One copy.

2. Applicable Consultant: One copy.

3. Owner’s Representative: One copy.

4. Number of copies for Contractor and supplier will be determined upon commencement of the work.

5. City and State agencies as appropriate.

1.05 RETESTING

A. If the Architect has reasonable doubt that materials comply with Specification requirements, additional tests shall be made as directed.

1. If additional tests establish that materials comply with Specification requirements, costs for such tests will be paid by the Owner.

2. If additional tests establish that materials do not comply with Specification requirements, costs for such tests shall be paid by the Contractor.

B. The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with the Contract Documents.

1. Cost of retesting shall be paid for by the Contractor.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish, install, and maintain temporary utilities as required to perform the work.

B. Materials, installation, and maintenance of temporary utilities shall comply with applicable regulatory requirements.

C. Remove temporary utilities, including associated materials and equipment when no longer required. Restore and recondition areas of the site damaged or disturbed by temporary utilities or their installation. Remove and properly dispose of debris resulting from removal and reconditioning operations.

1.02 TEMPORARY UTILITIES

A. Temporary Electric Power and Lighting:

1. Arrange with electric utility service company to provide service for power and lighting. Pay the costs for service and for power used.

2. Distribute electric power and lighting.

3. Provide lighting and convenience outlets in the temporary structures, and as otherwise required for the performance of the work.

B. Temporary Heat, Ventilation, and Air Conditioning:

1. Provide and pay for heat and air conditioning devices as required to maintain specified conditions for construction operations.

2. The permanent heating and air conditioning system may be used as a source of temporary heat and air conditioning after the system is placed in operation and tested, provided Owner's Representative has approved in writing use of the permanent system.

3. Arrange for service and pay costs in connection therewith and maintain system until acceptance of the Project.

4. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

5. Building heating and air conditioning fans shall not be used unless required filters are in place.

C. Temporary Lighting:

1. Provide artificial lighting for work areas when natural light is not adequate to inspect work.

2. Exterior staging and storage areas and pathways shall remain electrically illuminated after dark.

3. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Temporary Water:

1. Arrange with the utility service company to provide temporary water service and distribution; pay the costs for service and for water used.

2. Following permanent service installation, temporary water may be taken from permanent source.

3. Install branch piping with taps located so that water for construction purposes is available throughout the work with hoses.

4. Make potable water available for human consumption.

E. Temporary Sanitary Facilities: Locate as approved by the Owner. Maintain in a neat, sanitary condition, adequately supplied.

1.03 CONSTRUCTION AIDS

A. Use of New Elevator and Stairs:

1. As soon as practical after installation, the new elevator and stairway may be placed in service for use for construction operations.

2. Protect elevator and stairway from damage from construction operations.

3. Do not overload elevator and stairway beyond their rated capacities.

1.04 BARRIERS AND ENCLOSURES

A. General:

1. Materials and construction shall comply with applicable regulatory requirements.

2. Provide and maintain suitable temporary barriers as required to prevent public entry; protect the work and existing facilities, and persons from damage or injury from construction operations.

3. Should regulatory requirements necessitate construction of temporary barriers, barricades, or pedestrian walkways not indicated or specified, construct at no increase in Contract Sum.

4. Install enclosure fencing with locking entrance gates where indicated or required to enclose site work. Provide open-mesh, chain-link fencing with posts.

5. Maintain temporary barriers in a structurally sound condition and neat appearance.

6. Relocate as required by progress of the work.

7. Restore and recondition site areas damaged or disturbed.

B. Provide and maintain temporary enclosures to separate work areas from areas occupied by Owner and to prevent the penetration of dust and noise into occupied spaces.

1. Construct with closed, sealed joints. Close or seal edges, penetrations, and intersections with other surfaces to prevent penetrations of dust and noise.

2. Construct in accordance with fire-resistive requirements of regulatory agencies where indicated; maintain fire exits.

3. Finish surfaces exposed to view in occupied areas as directed.

1.05 SECURITY

A. Secure, maintain, and protect the work, stored materials, equipment, and temporary facilities until time of acceptance, or such earlier time as Owner may choose to assume such responsibility.

B. Install temporary enclosure of partially completed construction areas to prevent unauthorized entrance, vandalism and theft.

C. Secure temporary storage areas as required to prevent theft.

1.06 TEMPORARY CONTROLS

A. Noise and Vibration Control:

1. Comply with applicable regulatory requirements for the operation of powered construction equipment.

2. Equipment and impact tools shall have intake and exhaust mufflers.

B. Dust and Dirt Control:

1. Conduct construction operations to prevent windblown dust and dirt from interfering with the progress of the work.

2. Periodically water exterior construction areas as required to minimize the generation of dust and dirt.

3. Hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins.

4. Prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drains.

C. Water Control: Do not permit surface or subsurface water, and other liquids to accumulate on or in areas adjacent to the Project site. Should such conditions be encountered or develop, control the water, or other liquid, and suitably dispose of by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

D. Pollution Control:

1. No burning of refuse, debris, or other materials will be permitted on or in the vicinity of the Project site.

2. Comply with regulatory requirements and anti-pollution ordinances during the performance of demolition, construction and disposal operations.

1.07 PROJECT IDENTIFICATION AND SIGNS

A. General: Project identification and signs shall be as required by the U.S. Department of Commerce Economic Development Association, OMB Number: 0610-0096 as indicated in Appendix E.

B. Signs other than the specified Project sign will not be permitted, unless otherwise approved in advance by the Architect.

1.08 FIELD OFFICES AND SHEDS

A. Furnish, install, and maintain field offices and sheds.

B. If required, construct, install, and maintain field offices and sheds in compliance with applicable regulatory requirements.

1. Construction shall be structurally sound, weathertight, with floors raised above the ground, sturdy doors with provisions for locking, temperature transmission resistance compatible with occupancy and storage requirements, and neat appearance maintained throughout duration of work.

2. Portable or mobile buildings complying with the specified requirements may be used.

3. Obtain Owner's Representative's approval of locations for field offices and storage sheds prior to commencing site preparation for the structures.

4. Construct field offices and sheds on proper foundations and provide connections for utility services. Fill and grade sites for field offices and storage sheds to facilitate surface drainage.

C. Remove field offices and sheds from the site as soon as the progress of the work permits. Remove foundations, steps, landings, utility services and contents. Grade and restore portions of the site occupied by the temporary structures.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interferences with performance of the work. Relocate and modify facilities as required by progress of the work.

END OF SECTION

SECTION 01 53 00

MOLD PREVENTION MEASURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Provide special administrative and procedural requirements to help prevent mold contamination in construction.

1. Formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to:

a. Presence of spores and nutrient sources.

b. Moisture; temperatures; climatic conditions; relative humidity.

c. Heating/ventilating systems, maintenance, and operating capabilities.

2. These factors are beyond control of the Architect who shall not be responsible for any claims, repairs, restoration, or damages relating to presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, etc. in any building or in the air, land, or water serving building.

1.02 QUALITY ASSURANCE

A. Preconstruction Meeting: Review measures to prevent mold contamination at Preconstruction Meeting.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent mold contamination. Comply with manufacturer's written instructions where available relating to mold contamination prevention.

B. Store materials off floor and cover with waterproof covering such as but not necessarily limited to insulation, gypsum products, wall coverings, carpet, wood products, and other products susceptible to mold contamination.

C. Remove from Project site damaged materials or materials that have become wet. Do not install wet materials or materials with signs of mold contamination.

1.04 SITE CONDITIONS

A. Immediately remove water found within the building during construction.

1. Provide water lift stations and sump pumps as early in the Project as possible. Use temporary pumps where necessary to get water out of the building and drain lines.

B. Maintain clean Project site, free from hazards, garbage, and debris.

C. Eating, drinking, and smoking are not permitted within the building.

D. Flash roof penetrations immediately. Do not allow water to penetrate to the floor below.

E. Monitor humidity and temperature for conformance to installation requirements defined by material and equipment manufacturers.

F. Check moisture content of gypsum board prior to applying finishes.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Remove materials that can support mold contamination and that are wet. Replace with new dry materials.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Roof Drains: Connect roof drains to risers and storm drainage lines as soon as possible.

B. Floor Drains: Connect floor drains as soon as possible. Clean out floor drain lines to mains prior to Substantial Completion.

C. Wall Assemblies: Install exterior wall insulation and gypsum board only after building is enclosed.

1. Keep bottom of installed gypsum board off floor 1/2-inch.

2. Protect gypsum board with polyethylene sheeting prior to placing gypsum cement underlayment.

D. Cavity Conditions: Clean and inspect cavity conditions prior to covering, sealing, or restricting access. Vacuum clean cavity spaces prior to covering or enclosing.

E. Plumbing: Pressure test plumbing piping identified as insulated on Project prior to installation of insulation.

F. HVAC Equipment: Permanent HVAC equipment shall not be used for temporary conditioning of the building during construction unless temporary disposable filters are in place.

3.02 DEMONSTRATIONS

A. Train and educate Owner's maintenance personnel on use of building systems. Explain how improper operation and shutting down systems during off periods can create mold problems.

B. Schedule with Owner a review of building for mold problems at one-year warranty walk-through.

1. Inspect exterior sealants and masonry joints for cracks and other damage and deterioration where water can penetrate building envelope.

END OF SECTION

SECTION 01 61 00

COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Administrative procedures for handling requests for substitutions made after award of the Contract are specified in Section 01 25 00.

1.02 DEFINITIONS

A. "Products" are items purchased for incorporation in the work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturers' published product literature, current as of the date of the Contract Documents.

C. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.

D. "Equipment" is a product with operational parts, whether motorized or manually operated, that require service connections such as wiring or piping.

1.03 SUBMITTALS

A. Product List Schedule: Prepare a schedule showing products proposed to be installed in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product name for each item listed.

1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.

2. Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:

a. Related Specification Section number.

b. Generic name used in Contract Documents.

c. Proprietary name, model number and similar designations.

d. Manufacturer's and name and address.

e. Supplier's name and address.

f. Installer's name and address.

g. Projected delivery date, or time span of delivery period.

3. Initial Submittal: Within 30 days after the date of commencement of the work, submit PDF copy of an initial product list schedule. Include an explanation for omissions of data and for known variations from Contract requirements.

4. Completed Schedule: Within 60 days after the date of commencement of the work, submit PDF copy of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

5. Architect's Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include the following:

1. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.04 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also optional.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producers' nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.

b. Model and serial number.

c. Capacity.

d. Speed.

e. Ratings.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

B. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

C. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

D. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

E. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

F. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

H. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within the range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having any of the following characteristics:

1. Made outside the United States, its territories, Canada, or Mexico.

2. Made using or containing CFC’s or HCFC’s.

3. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the Project.

2. Have a longer documented life span under normal use.

3. Result in less construction waste.

4. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

2. Semi-Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

3. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

4. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

5. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

6. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

7. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with a code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

8. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

9. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 64 00

OWNER-FURNISHED PRODUCTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for the following:

1. Providing utility and rough-ins and installing Owner-furnished products.

2. Provide utility and rough-ins required for Owner-furnished and installed products.

1.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store and handle products upright and in accordance with the manufacturer's instructions.

B. Protect products as required to prevent damage during storage and construction.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Contractor's Responsibilities:

1. Verify mounting and utility requirements for specified product items.

2. Provide mounting and utility rough-in for product items where required, regardless of responsibility designation.

a. Rough-in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.

b. If the Owner substitutes items like those scheduled, there shall be no change in rough-in cost, unless substitution occurs after rough-in has been completed or rough-in involves other mounting requirements, utilities or utilities of different capacity from that required by item originally specified.

3. For products designated to be Owner furnished, the Owner will make available manufacturer's literature or information and shop drawings showing required mounting and rough-in information.

B. Products furnished by the Owner, installed by the Contractor (OFCI)

1. General: The Owner and the Contractor will coordinate deliveries to coincide with the construction schedule.

2. The Owner will furnish indicated or specified products with rough-in dimensions and characteristics indicated and tailgate deliver to the site.

3. The Contractor Shall:

a. Receive products at site and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Contractor shall assume responsibility for such defects and omissions.

b. Store products until ready for installation and protect from loss and damage.

c. Uncrate, assemble, and set in place.

d. Provide required backing plates.

e. Install products in accordance with manufacturer's recommendations, instructions, and shop drawings under supervision of manufacturer's representative where specified, supplying labor and material required and making mechanical, plumbing, and electrical connections required to operate products.

C. Compatibility with Space and Service Requirements:

1. Products shall be compatible with space limitations indicated and with mechanical and electrical services indicated and specified in other Sections.

2. Modifications to products required to conform with space limitations or with utility services specified for rough-in shall not cause additional costs to the Owner.

D. Manufacturer's printed descriptions, specifications, and instructions shall govern the work unless specifically indicated or otherwise specified.

E. Specifications, standards, tests, and recommended methods cited in this Section to govern use of items of equipment shall also govern component parts.

2.02 OWNER-FURNISHED PRODUCTS

A. Owner-furnished products are indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with the manufacturers' instructions and the applicable requirements specified in other Sections.

B. Set items securely in place, rigidly or flexibly mounted in accordance with manufacturer's directions.

C. Securely attach to backing plates as required.

D. Make electrical and mechanical connections as indicated and required.

E. Touch-up and restore damaged or defaced finishes.

3.02 ADJUSTMENT, CLEANING, AND PROTECTION

A. Repair or replace items not acceptable to the Architect.

B. Upon completion of installation, clean products in accordance with manufacturers' recommendations, and protect from damage until final acceptance of the work.

3.03 TESTING

A. Contractor-installed products shall be tested after installation in the presence of the Owner, Architect, and manufacturer.

B. Correct defects or replace and retest as required. Repairs, replacement, and retesting shall be made at no additional cost to the Owner.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for performing cutting and patching.

B. Cutting and patching includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

C. Related Sections:

1. Selective structure demolition is specified in Section 02 41 19.

2. Historic demolition is specified in Section 02 41 91.

1.02 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform the work.

4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

B. Furnish record of experience qualifying the roofing installation firm as a specialist in the installation of the existing system or similar system. Include a written record indicating Projects on which the installer has worked, with the name and address of the purchasers of the service and location of the work performed.

1.03 QUALITY ASSURANCE

A. Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load deflection ratio.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be identical to existing materials. If identical materials are not available, use materials that visually match existing adjacent surfaces.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before cutting existing surface, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.02 PREPARATION

A. Temporary Support: Provide temporary support for work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

2. Take precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

4. Bypass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate the integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched areas has received primer and second coat.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar materials. Clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original conditions.

END OF SECTION

SECTION 01 74 00

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Perform cleaning and disposal operations during the progress and completion of the work.

B. Cleaning for specific products or work is specified in the individual Specification Sections.

C. Related Sections:

1. Construction waste management is specified in Section 01 74 19.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with applicable regulatory requirements during cleaning and disposal operations.

B. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of them in a lawful manner.

C. Vacuum cleaners shall have high efficiency particulate arrester (HEPA) filters. Provide environmentally benign cleaning materials, which can be found at www.sustainable-cleaning.com and www.cleanersolutions.com. Be especially careful during final touch-up and cleaning to ensure that cleaning crews do not deviate from the low or zero VOC content requirement for VOC-containing cleaning products.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

A. Use cleaning materials which will not create hazards to health or property or cause damage to products.

B. Use cleaning materials and methods recommended by the manufacturers of the products to be cleaned.

C. Cleaning materials shall be clearly labeled.

PART 3 - EXECUTION

3.01 CLEANING DURING CONSTRUCTION

A. Perform cleaning operations as required to keep the work, site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from the site on a weekly basis or more often as conditions require and dispose in legal disposal areas away from the site.

D. Retain stored items in an orderly arrangement allowing access. Do not impede traffic or drainage.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of painting and the application of other finishes and continue cleaning as required until such work is completed.

B. Schedule cleaning operations to prevent dust and other contaminants from adhering to wet or newly finished surfaces.

3.03 FINAL CLEANING

A. Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturer's instructions.

B. Remove labels that are not permanent.

C. Clean transparent materials, including mirrors and glass in doors and windows, both interior and exterior. Remove glazing compound and other substances that are visible vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

D. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Vacuum carpeted surfaces. Other flooring surfaces shall be mopped and/or cleaned in accordance with flooring manufacturer's recommendations.

E. For surfaces requiring routine application of buffed polish, apply the polish recommended by the flooring manufacturer and polish.

F. Clean permanent filters and replace disposable filters one week prior to building occupancy.

G. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures, lamps, and bulbs. Clean out strainers after equipment start-up.

H. Clean site, including landscape development areas of rubbish, litter, and other foreign substances. Sweep paved areas clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth even textured surface.

I. Remove temporary protection and facilities installed for protection of work during construction.

J. Prior to final completion or Owner's occupancy, conduct an inspection of sight-exposed interior and exterior surfaces to verify that the entire work is clean and acceptable to the Owner.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.

2. Recycling nonhazardous construction waste.

3. Disposing of nonhazardous construction waste.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. Recycled and/or salvage for reuse a minimum of 50-percent of the nonhazardous construction and demolition waste.

B. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with specified requirements.

1.04 SUBMITTALS

A. Waste Management Plan: Submit a construction waste management plan and update as necessary.

1. Identify location for collection, separation and storage of recyclable construction waste.

2. Identify materials to be diverted from disposal by efficient usage, recycling, reuse, manufacturer's reclamation, or salvage for future use, donation or sale.

3. Identify percentage of materials to be diverted, calculated by weight or volume, but not both.

4. Maintain receipts or other documentation related to diversion through the course of construction. Furnish evidence of diversion when requested by the Architect or code official.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: For the purposes of this Section, construction materials and waste shall include, but not be limited to:

1. Materials delivered to the site and intended for installation prior to the issuance of the Certificate of Occupancy, including related packaging.

2. Construction materials and waste removal during demolition or razing, if applicable.

3. Construction waste shall not include land-clearing debris, excavated soils, and fill and base materials.

B. Recycling Receivers and Processors: Refer to www.wbdg.org/tools/cwm.php for information on available recycling receivers and processors.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the Project site. Include a list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.

4. Store components off the ground and protect from the weather.

5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.02 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from the Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood

C. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.03 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 74 23

CONSTRUCTION INDOOR AIR QUALITY

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes construction indoor air quality (IAQ) requirements and includes administrative and procedural requirements for the development and execution of a construction air quality management plan.

1.02 IAQ REQUIREMENTS

A. Indoor Contaminant Control during Construction: After installation, seal permanent ducts and vents to minimize contamination during construction. Remove any seals after phases of construction are completed.

B. Preoccupancy Flush: Flush the building with fresh air, according to the following guidelines:

1. Flush prior to occupancy but after construction is completed.

2. Flush the entire building, keeping interior doors open.

3. Flush for 48 total hours; the hours may be nonconsecutive, if necessary.

4. Keep windows open and run a fan (HVAC system fan) continuously or flush the building with HVAC fans and exhaust fans operating continuously at the highest flow rate.

5. Use additional fans to circulate air within the building.

6. Replace temporary HVAC air filters.

1.03 SUBMITTALS

A. IAQ Plan for the construction and pre-occupancy phases of the Project.

B. Photographs documenting construction IAQ management measures implemented during construction such as duct protection measures and measures to protect on-site stored or installed absorptive materials from moisture.

C. Cut sheets of filtration media used during construction and installed immediately prior to occupancy with MERV values highlighted.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for the following items of the Contract Closeout:

1. Project record documents.

2. Operating and maintenance data.

3. Service and maintenance contracts.

4. Preparation for final inspection.

5. Damage and restoration.

6. Remedial work.

1.02 PROJECT RECORD DOCUMENTS

A. Maintenance of Documents and Samples:

1. Store Project documents and samples in the field office apart from documents used for construction.

2. Maintain Project documents in a clean, dry, legible condition and in good order.

3. Do not use Project record documents for construction.

B. Recording:

1. Record information carefully and neatly, with felt tip pens, in color code designated, and in the manner approved in advance by the Architect.

2. Label each document "Project Record" in large, neat, printed letters.

C. Record Drawings:

1. Record the following kinds of information on prints:

a. Changes made by Change Orders and other modifications described in the General Conditions.

b. Locations of work buried under or outside the building, such as plumbing and electrical lines and conduits.

c. Locations of work concealed inside the building whose general location is changed from that indicated on the Contract Documents.

d. Locations of items, not necessarily concealed, which have been changed, with the Architect's prior approval, from the locations indicated on the Contract Documents.

e. Locations of significant items such as main power disconnect, main water and gas shutoffs, motor disconnects, filters, controls, isolating valves and the like shall be highlighted on the record drawings.

f. In addition to the previously specified requirements for record drawings:

1) Keep up to date during the entire progress of the work and make available to the Architect.

2) Furnish additional drawings necessary for clarification.

3) Record deviations from the sizes, locations, and other features of installations shown in the Contract Documents.

4) Establish locations of underground work by dimensions to column lines or walls, locating turns, and by referenced centerline or invert elevations and rates of fall.

5) Give adequate information to locate work concealed in the Building.

6) Drawing to Scale:

a) Locate main runs of piping, conduit, ductwork, and similar items by dimensions.

b) Locate other items either by dimensions or in relation to spaces within the building.

2. Furnish record drawings, made from final Shop Drawings, updated to show actual conditions, for specified work.

D. "As-Built" Drawings: At time of acceptance of the work and prior to final payment, using the record drawings for reference, prepare "As-Built" drawings.

E. Specifications and Addenda: Mark each Specification Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment incorporated in the work.

2. Changes made by Change Order and other modifications described in the General Conditions.

F. Large Scale Layout Drawings:

1. The preparation of large-scale detailed layout drawings may be required for the work of Divisions 22, 23, and 26 of the Specifications. These layout drawings are not Shop Drawings as defined by the General Conditions, but, together with Shop Drawings or layout drawings of affected Sections, are used to check, coordinate, and integrate the work of the various Sections.

2. If furnished, include the layout drawings as part of the Project record documents.

G. Record Construction Schedule: Using the latest Progress Schedule required by Section 01 33 00 as a reference, submit a Record Construction Schedule showing the actual dates and duration of construction activities.

H. Sign and date the completed Project record documents; deliver to the Architect who will deliver to the Owner's Representative after final acceptance of the work.

1.03 PRODUCT DATA

A. Furnish PDF copy of manufacturers' product data, specifications, installation instructions, and maintenance instructions for products incorporated in the work; information specified herein shall be for products in addition to equipment items requiring operating and maintenance data specified elsewhere in this Section.

B. Sign and date the completed product data, and submit to the Architect, who will deliver them to the Owner's Representative.

1.04 OPERATION TESTS

A. Conduct operational tests as required to demonstrate that systems have been completed and comply with all requirements.

B. Furnish a written record of test results using recording type instruments where applicable and as directed.

1.05 OPERATING AND MAINTENANCE DATA

A. General: Where maintenance manuals, record data, and operating instructions are specified, include the following in PDF format:

1. Typewritten index near the front of the manual indicating locations of emergency data for equipment included in the manual.

2. Instructions regarding operation and maintenance of the equipment included in the manual.

3. Replaceable parts, part numbers, cost, and name and address of nearest parts distributor.

4. Copy of each warranty and service contract issued for the equipment included in the manual.

5. Include additional data required for the Owner's operation and maintenance.

B. Catalog Data: Where contents of manuals include manufacturers' catalog pages, indicate the items included in the Project and delete data that is not applicable.

C. Shop Drawings: Furnish one PDF set of reviewed Shop Drawings showing changes made during construction.

1.06 SERVICE AND MAINTENANCE CONTRACTS

A. Compile, review, and submit specified service and maintenance contracts as specified for warranties and bonds.

1.07 PREPARATION FOR FINAL INSPECTION

A. Perform final cleaning as specified in Section 01 74 00.

B. Assemble warranties, service, and maintenance contracts, operating and maintenance instructions, and other items as specified, and submit to the Architect.

C. Remove temporary tapes, wrapping, coatings, paper labels, and other similar items. Dust, mop, wash, or wipe exposed and semi-exposed surfaces.

D. At the Contractor's request, the Architect will attend a pre-final detailed Project review, to allow the Contractor to gather most punch list items while the subcontractors are still on the Project. Provide a typewritten list of items remaining to be completed or corrected. List by room number and item number. Segregate plumbing, HVAC, and electrical on separate lists.

E. At the Contractor's request, the Architect will make a final Project review when the items in the pre-final punch list have been completed and after final cleanup, operation tests and the like have been performed.

F. When the Architect determines that the Project is substantially complete and that final punch list items are completed, a final Project Inspection Report will be executed.

G. Upon execution of the Final Project Inspection Report, record and pay for Notice of Completion and furnish copies to the Architect.

H. Provide dates, duration, and methods used to conduct preoccupancy flush of at least 48 totals hours (maybe nonconsecutive) prior to occupancy but after all phases of construction are completed. Ensure that HVAC filters are replaced or cleaned as necessary.

1.08 RESTORATION OF DAMAGED WORK

A. Restore or replace damaged materials and finishes caused by movement of equipment or other operations as specified or directed by the Architect, at no additional cost to the Owner.

B. Restoration shall be equal to the original work, and finishes shall match the appearance of existing adjacent work.

1.09 REMEDIAL WORK

A. Replace work due to faulty workmanship or materials at no additional cost to the Owner.

B. Coordinate work with the Owner’s Representative and perform at such time and manner to cause minimal interruption and inconvenience to the Owner’s operations.

1.10 EXTRA MATERIALS

A. Where specified, provide extra materials in the quantities and manner specified.

B. Delivery and certification of extra materials shall be prerequisite to Substantial Completion.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.

2. Emergency manuals.

3. Operation manuals for systems, subsystems, and equipment.

4. Product maintenance manuals.

5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Submittal procedures are specified in Section 01 33 00.

2. Closeout procedures are specified in Section 01 77 00.

3. Project record documents are specified in Section 01 78 39.

4. Refer to Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the work in those Sections.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.

2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit a draft copy of each manual at least 30 days before commencing demonstration and training. The Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15-days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit PDF revised copy of each corrected manual within 15-days of receipt of Architect's comments and prior to commencing demonstration and training.

2. Authorization for final payment will not be made prior to final acceptance of the Manual.

PART 2 – PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.

2. List of systems.

3. List of equipment.

4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.

3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.

2. Name and address of Project.

3. Name and address of Owner.

4. Date of submittal.

5. Name and contact information for Contractor.

6. Name and contact information for Architect.

7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include a comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by the manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.03 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.

2. Emergency instructions.

3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.

2. Flood.

3. Gas leak.

4. Water leak.

5. Power failure.

6. Water outage.

7. System, subsystem, or equipment failure.

8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.

2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.

4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

2.04 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Performance and design criteria if Contractor has delegated design responsibility.

3. Operating standards.

4. Operating procedures.

5. Operating logs.

6. Wiring diagrams.

7. Control diagrams.

8. Piped system diagrams.

9. Precautions against improper use.

10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.

3. Equipment identification with serial number of each component.

4. Equipment function.

5. Operating characteristics.

6. Limiting conditions.

7. Performance curves.

8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.

3. Color, pattern, and texture.

4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.

2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with the name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 – EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared record drawings in Section 01 78 39.

G. Comply with Section 01 77 00 for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 36

WARRANTIES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

B. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 02 through 48.

C. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.02 DEFINITIONS

A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.03 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged from such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty: When work covered by a warranty has failed and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace, or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Architect.

1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner's Representative for approval prior to final execution.

C. Form of Submittal: At Final Completion compile PDF copy of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual. Use the warranty form in Section 01 78 37.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01 78 37

FORM OF WARRANTY

WARRANTY FOR _____.

We hereby warrant that all materials and equipment for the_____ that we have provided at _____ are new, unless otherwise specified, and that all work is of good quality, free from faults and defects and in conformance with the Contract Documents. Work not conforming to these requirements, including "equals" not properly approved and authorized, will be considered defective.

If within one year after the Date of Substantial Completion of the work or within one year after acceptance by the Owner of designated equipment, or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, a portion of the work is found to be defective or not in accordance with the Contract Documents, we agree to correct it promptly after receipt of a written notice from the Owner to do so; unless the Owner has previously issued a written acceptance of such condition. This obligation shall survive termination of the Contract.

If we fail to commence compliance with the above paragraph within 7 calendar days after receipt of written notice from the Owner to do so, or fail to pursue such compliance with diligence we, jointly and severally, do hereby authorize the Owner to have said defective work and damages repaired or replaced and made good at our sole expense, including compensation for the Owner's consultants' additional services made necessary by such default, and we will honor and pay the costs and charges for it together with interest at the maximum rate then permitted by governing obligations, and if the Owner brings action to enforce this warranty, we agree to pay the Owner's reasonable attorney's fees incurred in connection therewith. This warranty is for ___ years.

Signed _____
(subcontractor's name, address, license number, and date of signing)

Countersigned _____
(Contractor's name, address, license number, and date of signing)

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.

2. Record Specifications.

3. Record Product Data.

4. Miscellaneous record submittals.

B. Related Sections:

1. Submittal procedures are specified in Section 01 33 00.

2. Closeout procedures are specified in Section 01 77 00.

3. Operation and maintenance data is specified in Section 01 78 23.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints.

2) The Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal: Submit PDF electronic files of scanned record prints.

B. Record Specifications: Submit Annotated PDF electronic files of Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities.

1. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 – PRODUCTS

2.01 RECORD DRAWINGS.

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and shop drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Accurately record information in an acceptable drawing technique.

b. Record data as soon as possible after obtaining it.

c. Record and check the markup before enclosing concealed installations.

d. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to the drawings.

b. Revisions to details shown in drawings.

c. Depths of foundations below first floor.

d. Locations and depths of underground utilities.

e. Revisions to routing of piping and conduits.

f. Revisions to electrical circuitry.

g. Actual equipment locations.

h. Duct size and routing.

i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Change Directive.

k. Changes made following Architect's written direction.

l. Details not on the original Contract Documents.

m. Field records for variable and concealed conditions.

n. Record information on the work that is shown only schematically.

3. Mark the Contract Documents and shop drawings completely and accurately.

4. Mark important additional information that was either shown schematically or omitted from original drawings.

5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers and similar identification where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file with comment function enabled.

2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

3. Identification:

   a. Project name.

   b. Data.

   c. Designation “PROJECT RECORD DRAWINGS”.

   d. Name of Architect.

   e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that specified, addenda, and contract modifications.

1. Mark copy with the proprietary name and model number of products, materials and equipment furnished, including substitutions and product options selected.

2. Record the name of manufacturer, supplier, installer, and other information necessary to provide a record of selections made.

3. For each principal product, indicate whether record product data has been submitted in operation and maintenance manuals instead of submitted as record product data.

4. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic files of marked-up paper copy of Specifications.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark product data to indicate the actual product installation where installation varies substantially from that indicated in product data submittal.

1. Include significant changes in the product delivered to the Project site and changes in manufacturer’s written instructions for installation.

2. Note related Change Orders, record Specifications and record drawings where applicable.

B. Format: Submit record product data as annotated PDF electronic file or scanned PDF electronic files of marked-up paper copy of product data.

1. Include record product data directory organized by Specification Section number and title, electronically linked to each item of record product data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic files or scanned PDF electronic files of marked-up miscellaneous record submittals.

PART 3 – EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Selective demolition and removal of portions of the existing building, as indicated and as required to perform the work.

B. Related Sections:

1. Cutting and patching is specified in Section 01 73 29.

2. Construction waste management is specified in Section 01 74 19.

3. Selective historic demolition is specified in Section 02 41 91.

1.02 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be salvaged or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and bring to Owner's designated storage area within the building.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then reinstalled in their original locations.

1.03 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the Project site.

1.04 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Proposed dust control measures.

C. Proposed noise control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

2. Interruption of utility services.

3. Coordination for cutoff, capping, and continuation of utility services.

4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed work.

6. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged, if any.

F. Inventory of items to be removed by Owner, if any.

G. Photographs or video, sufficiently detailed, of existing conditions, of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

H. Record drawings at Project closeout. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition work like that required for this Project.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with noise and dust regulations of authorities having jurisdiction.

C. Pre-Demolition Conference: Conduct conference at the Project site. Review methods and procedures related to building demolition including, but not limited to, the following:

1. Inspect and discuss condition of building to be demolished.

2. Review structural load limitations of existing structure.

3. Review and finalize schedule and verify availability of equipment, personnel, and facilities required.

4. Review areas where existing construction is to remain and require protection.

5. Review methods for removing materials from the site.

6. Review staging area for materials on the site.

1.06 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of buildings to be selectively demolished. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Hazardous Materials: It is not expected that asbestos or other hazardous materials will be encountered in the demolition work. If any materials suspected of containing asbestos or other hazardous materials are encountered, do not disturb the materials. Immediately notify the Architect and the Owner. The Owner will arrange to have hazardous materials removed under a separate contract.

C. Storage or sale of removed items or materials on-site will not be permitted.

1.07 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's use of existing adjacent buildings.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities not to be re-used have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the demolition work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and governing authorities.

2. Provide not less than 72-hours notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.

2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

3.03 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Protect walls, ceilings, floors and other existing finish work that are to remain and are exposed during selective demolition operations.

D. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise. Coordinate with Section 01 50 00.

1. Unless otherwise indicated, construct dustproof partitions of not less than nominal 4-inch studs and 5/8-inch Type X gypsum board with joints taped on occupied side.

2. Insulate partition to provide noise protection to occupied areas.

3. Seal joints and perimeter. Equip partitions with dustproof, fire-rated doors and locking hardware where indicated or required.

4. Protect air handling equipment.

5. Weatherstrip exterior openings.

E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

1. Strengthen or add new support when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to the condition existing before start of selective demolition.

3.05 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until the work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower them to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. On-site storage of removed items is prohibited.

10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Salvaged Items:

1. Sort and organize salvaged materials as they are removed from the structure.

2. Pack, crate or band materials to keep them contained and organized.

3. Store items in a secure and weather protected area until removed from the site or transferred to Owner.

4. Transport items to Owner's storage area designated by the Owner.

5. Protect items from damage during transport and storage.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition activities. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.

D. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

E. Remove air-conditioning equipment without releasing refrigerants.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled or otherwise indicated to remain Owner's property, remove demolished materials from the Project site and legally dispose of them.

1. Do not allow demolished materials to accumulate on site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of the building by chute, hoist or other device that will convey debris to grade level in a controlled descent.

4. Comply with requirements specified in Section 01 74 19.

3.07 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

3.08 CONSTRUCTION WASTE MANAGEMENT

A. As specified in Section 01 74 19.

END OF SECTION

SECTION 02 41 91

SELECTIVE HISTORIC DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes requires the selective inventory, removal and subsequent reinstallation, salvage, storage, or off-site disposal of historic fabric including but not limited to the following:

1. Removal and protection of exterior historic fabric items as indicated or as required to accommodate repairs or provide access for work in this Project.

2. Protection of exterior existing historic fabric to remain in place.

B. Historic Building – Required care in selective demolition:

1. The work of this Section is to preserve the character of the historic building and to salvage building materials and components for subsequent reinstallation rather than replacement, where indicated.

2. Historic building material and components shall be considered very fragile and shall be dismantled, removed, worked-on, transported, and handled with special care. Historic materials damaged during selective demolition operation may not be available for replacement, and repair and restoration may be required. The cost of such repair and restoration shall be borne by the Contractor. Protection of existing materials, surfaces and finishes is of great importance.

C. Related Sections:

1. Cutting and patching is specified in Section 01 73 29.

2. Selective structure demolition is specified in Section 02 41 19.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Submit the following prior to performing any demolition or removal work.

1. Contractor’s qualifications.

2. Schedule of selective demolition indicating proposed sequence of operation for selective demolition work.

3. Sample format for historic fabric removal inventory form indicating original location, material description, photo and/or drawing reference, condition and storage location.

4. Historic fabric protection plan.

5. Documentation of historic fabric to be removed, including photographs and/or drawings.

6. Existing Conditions Photographs: Photographs of existing conditions of surfaces, materials, equipment, and adjacent improvements that might be misconstrued as damage relating to selective demolition operation. File with Owner’s Representative prior to start of work. Insufficient documentation of damaged items prior to the start of work may result in the Contractor’s responsibility to restore these items.

1.03 QUALITY ASSURANCE

A. Contractor's Qualifications: Protection, documentation, removal and handling of historic fabric shall be supervised by personnel with 5 yearsexperience in similar work on historic structures.

B. Comply with the requirements in the Historic Preservation Certification Application (HPCA).

1.04 JOB CONDITIONS

A. Pre-construction Conference: Prior to submittals and prior to any demolition, a pre-construction conference between the Contractor and the Owner's Representative will be held to review requirements and procedures. The conference shall include a walk-through of the building and a detailed report for the record.

B. Protection:

1. Protection shall be in place prior to any other work in the area. Paths of access for workers and materials and all areas subject to impact from the work shall be protected throughout the Project. Protection shall be maintained throughout the Project and repaired or modified as required.

2. Provide protection for exterior doors, door frames, windows, sash and glass to remain. Protect existing materials along path of travel route for workers and materials, including main entry.

3. Protect other exterior historic elements to remain in place.

C. Identification of Materials to be Removed: Tag each item of historic fabric that is to be removed for review by the Architect and Owner's Representative. Tags shall be attached in a manner that will not damage sensitive historic finishes. No duct tape or attachments onto finish surfaces will be permitted.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 GENERAL

A. Provide shoring, bracing or support to prevent movement, settlement or collapse of areas of selective demolition and adjacent historic fabric to remain.

1. Where openings are required in surfaces of exposed dimensional materials such as stone, ceramic tile, woodwork, etc, carefully cut openings along joint lines. Use tools where a blade thickness narrower than joint thickness whenever possible. Only remove whole pieces of materials. Do not mar or abrade exposed surfaces. Retain removed section for reinstallation or as indicated or as directed by the Owner's Representative. Document salvaged items.

2. Do not use manual or power-driven impact tools where such use may damage existing historic fabric. Use of power tools shall be approved by the Owner's Representative.

3. Protect adjacent material from impact of removal process.

B. Coordinate these instructions and specifications with hazardous material removals, as required.

3.02 SALVAGE

A. Remove and clean items to be reused or returned to the Owner. Store items to be reused in a protected location until reinstalled.

B. Salvage items for reuse shall be listed in a historic fabric removal inventory form. The location and condition of salvaged and stored materials shall be continuously updated and maintained.

END OF SECTION

SECTION 03 05 00

CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes a clear concrete floor sealer on concrete floors where scheduled.

B. Related Sections:

1. Cast-in-place concrete is specified in Section 03 30 00.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. Concrete floor sealer shall react with concrete surfaces to produce a dense, hydrophobic, insoluble, moisture barrier to seal out contaminants, while hardening and densifying concrete surface.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's product data and application and installation instructions.

C. Warranty.

1.04 JOB CONDITIONS

A. Ensure concrete has been cured for a minimum of 3-days, is free of curing compounds and other sealers, and is free of laitance, grease, oil, and contaminants.

B. Protect adjacent surfaces/areas from damage due to overspray.

1.05 WARRANTY

A. Warranty sealed concrete floors to be free of dusting from abrasion for a period of 10 years from Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The Euclid Chemical Company “Ultrasil Li+”, Laticrete / L&M “Seal Hard” or approved equal.

2.02 MATERIALS

A. Concrete Sealer: Lithium silicate densifier; water based, deep penetrating, minimum 15-percent active ingredient solution containing lithium silicate designed to harden, densify, and dustproof concrete surfaces.

1. VOC Content: Not more than 5 g/L.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure surfaces are clean and free of all contaminants and any film forming compounds or sealers.

B. Ensure concrete has been cured a minimum of 3-days.

C. Test concrete surface for Ph levels and verify that Ph levels are acceptable to sealer manufacturer.

3.02 APPLICATION

A. Apply concrete floor sealer to interior concrete floors where scheduled, in accordance with manufacturer's instructions.

B. Apply directly from container onto prepared surfaces, undiluted.

C. Apply at a minimum rate of 1-gallon per 150- to 200-sq. ft. unless otherwise recommended by sealer manufacturer.

D. Allow surfaces to remain wet with sealer for 30- to 60-minutes.

E. Remove excess sealer at end of application by water flushing and squeeging dry.

F. Apply in one coat. Apply two coats to porous concrete surfaces.

END OF SECTION

SECTION 03 35 19

POLISHED CONCRETE FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for providing a polished concrete floor finish where scheduled.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:

1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008-inch wear in 30-minutes.

2. Reflectivity: Increase of 35-percent as determined by standard gloss meter.

3. Waterproof Properties: Rilem Test Method 11.4, 70-percent or greater reduction in absorption.

4. High Traction Rating: NFSI 101-A, ANSI B101.1 2009 non-slip properties.

B. New Concrete Design Requirements:

1. Hardened Concrete Properties:

a. Minimum Concrete Compressive Strength: 3,500-psi.

b. Nominal Weight Concrete: No lightweight concrete.

c. Non-air entrained.

2. Placement Properties:

a. Natural concrete slump of 4-1/2- to 5-inches. Admixtures may be used.

b. Flatness Requirements:

1) Overall FF 50.

2) Local FF 40.

3. Hard-Steel Troweled (3 passes) Concrete: No burnishing marks. Finish in accordance with ACI 302.1R, paragraph 8.3.11, Class 5 floor with hard steel troweled finish or Class 6 floor with hard steel troweled finish.

4. Curing Options:

a. Membrane forming curing compounds, ASTM C309, Type 1, Class B, all resin, dissipating cure.

b. Sheet membrane, ASTM C161.

c. Damp Curing: Seven-day cure.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Shop Drawings:

1. Typical layout including dimensions and floor grinding schedule.

2. Plan view of floor and joint pattern layout.

C. Product Data: Manufacturer's product data and application and installation instructions.

D. Warranty.

1.04 QUALITY ASSURANCE

A. Installer: Minimum of 5-years' experience in performing work of this Section who has specialized in installation of work like that required for this Project. The installer shall be trained and hold a current certificate as a manufacturer-certified installer.

B. Regulatory Requirements: NFSI Test Method 101-A Phase Two Level High Traction Material.

C. Mock-up: Prepare 10-foot x 10-foot mock-up where directed by the Architect. Construct mock-up using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in mock-up panels. Mock-up shall be polished by the individual workers who will be performing the work for the Project. Obtain written approval from Architect before start of work. Retain approved mock-up for use a s quality standard for finished work.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver products in original, unopened containers with legible manufacturer's identification and information.

C. Store specified products in conditions recommended by the manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50- and 90-degrees F. during application and at least 48-hours after application.

B. Protection: Take precautions to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

C. Coordinate the curing and protection of cast-in-place concrete floor with the work of Division 03.

1.07 WARRANTY

A. Warrant polished concrete floors to be free from defects in materials and workmanship for a period of 10 years from date of Substantial Completion. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Laticrete / L & M or approved equal.

2.02 MATERIALS

A. Concrete Hardener, Sealer, Densifier: Laticrete / L & M “FGS Hardener Plus”; water-based, colorless liquid, VOC-compliant hardening solution leaving no surface film.

B. Joint Filler: Laticrete / L & M “Joint Tite 750”; semi-rigid, 2-component, self-leveling, 100-percent solids, rapid curing, polyuria control joint and crack filler with Shore A 80 or higher hardness.

C. Cleaning Solution: Laticrete / L & M “FGS Concrete Conditioner”; proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified high traction by National Floor Safety Institute (NFSI).

D. Dye: Laticrete / L & M “Vivid Dye WB Plus”; concentrated formula designed to penetration and color concrete. Color as selected by the Architect.

E. Stain Guard Sealer: Laticrete / L & M “Permaguard SPS”; ready to use, low odor, VOC-compliant, topical sealer consisting of low molecular emulsified cross-linking, coupling polymers that effectively protect concrete.

F. Concrete Finish: High gloss, 1500 grit unless otherwise directed by the Architect or as required to match approved mock-up.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Verify that conditions are acceptable for installation. Do not proceed with installation until unacceptable conditions are corrected.

B. Concrete surfaces shall be inspected by a factory-trained installer.

C. Verify that new concrete floor surfaces are finished as specified.

3.03 INSTALLATION

A. Floor Surface Polishing and Treatment:

1. Provide polished concrete floor treatment in entirety of slab were required. Provide consistent finish in all contiguous areas.

2. Apply floor finish prior to installation of fixtures and accessories.

3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit.

a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Following the initial passes of metal bond diamonds, the installer shall drop back a minimum of one grit level when transitioning to resin bond diamonds. The separation in grit designation shall be a minimum of 50 for the transitioning step. The installer shall refine each abrasive grit to its fullest potential before moving on to the next level. Floor shall be thoroughly scrubbed between each grit pass to remove all loose material. The level of sheen shall match approved mock-up.

b. Expose aggregate in concrete surface only as determined by approved mock-up.

c. All concrete surfaces shall be as uniform in appearance as possible.

4. Dyed Concrete:

a. Grind through the 200-grit level prior to the first dye application. Apply with a hand pump sprayer in a consistent, overlapping circular motion. Mop out excess dye to minimize spotting. Allow the dye to dry and scrub with water and brush or white pad removing the dye residue.

b. Grind through the 400-grit level and apply a second coat mixed with "Lion Hard". Use a mop or microfiber pad to disperse the puddles. Allow to dry and scrub with water and a brush or white pad removing dye residue.

5. Natural Grey Polished Concrete: Polish concrete to the 1,500-grit level unless otherwise directed by the Architect or as required to match approved mock-up.

6. Hardener:

a. Apply the first coat of FGS Hardener Plus at 250-sg. ft./gal following the 400-grit level.

b. Apply a second coat of FGS Hardener Plus at 350-sq. ft./gal. prior to the final polishing pass.

c. Follow manufacturer's recommendations for drying time between successive coats.

7. Remove defects and re-polish defective areas.

8. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.04 ADJUSTMENTS

A. Re-polish those areas not meeting specified gloss levels or mock-up.

b. Fill joints flush to surface prior to the start of polishing operations.

3.05 PROTECTION

A. Protect the floor from traffic during construction operations in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 03 54 13

GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing gypsum cement floor underlayment.

B. Related Sections:

1. Acoustical underlayment is specified in Section 09 60 13.

1.02 SUBMITTALS

A. General: As specified in Section 01 33 00.

B. Product Data: Manufacturer's descriptive, technical data and illustrations, marked to indicate product types, variations, and materials.

1.03 QUALITY ASSURANCE

A. Installer: Minimum 3-years' experience installing gypsum concrete floor underlayment.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: As specified in Section 01 61 00.

B. Deliver materials in their original, unopened packages and protect them from exposure to the elements.

C. Store materials indoors, protected from moisture and other sources of damage.

1.05 PROJECT CONDITIONS

A. Maintain a temperature above 50-degrees F. until subfloor surface has stabilized.

B. Provide continuous heat and mechanical ventilation until the floor underlayment is dry.

C. Drying Requirements:

1. Coordinate construction scheduling and activities so that windows can remain operable and unobstructed during the placement and drying of gypsum cement underlayment.

2. For areas that are furthest from windows, provide supplemental fans, heaters and other drying equipment as required for drying. Monitor enclosed spaces for proper air flow for the duration of the drying process. Coordinate electrical requirements with the Contractor including when equipment will be used concurrently with other electrical power equipment.

3. Drying and heating equipment shall be checked and monitored daily to ensure proper operation.

4. Gypsum cement drying times may impact the overall construction schedule.

D. Verify that gypsum cement is sufficiently dry with moisture content less than 4-percent before staging materials on top of it. Avoid placing construction materials in direct contact with gypsum cement underlayment before it has dried sufficiently.

E. Periodically test humidity and moisture levels in gypsum board 2- to 3-inches above the surface of the poured underlayment to verify that moisture is not being transferred from the wet gypsum underlayment to the gypsum board.

F. Follow manufacturer's additional requirements.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Maxxon “Gyp-Crete 2000/3.2K”, USG “Levelrock Brand 2500 Series” or approved equal.

2.02 MATERIALS

A. Self-Leveling Poured Underlayment: Gypsum cement.

B. Primer: As recommended by underlayment manufacturer for subfloor to be leveled.

C. Sand Aggregate: 1/8-inch or less, washed masonry or plaster sand.

D. Water: Potable, free from impurities.

E. Acoustical Mat Underlayment: As specified in Section 09 60 13.

F. Sealer: As recommended by gypsum concrete floor underlayment manufacturer for sealing underlayment where glue-down flooring is to be applied.

2.03 PERFORMANCE REQUIREMENTS

A. Compressive Strength: 2,000-psi.

B. Dry Density: 115-pcf.

C. Point Loading: Minimum loading of 2,500-pounds on a 1-inch diameter disc.

D. Surface Burning Characteristics:

1. Flame Spread: 0.

2. Fuel Contributed: 0.

3. Smoke Density: 0.

PART 3 - EXECUTION

3.01 SUBSTRATE PREPARATION

A. Clean substrate free from dirt, dust, and other loose particles or materials, using power blower or vacuuming, as necessary.

B. Prime substrates and pretreat substrate joints and cracks in accordance with manufacturer's instructions.

C. Fill cracks and voids with a quick-setting caulk or drywall patching compounds where leakage of gypsum concrete underlayment could occur.

3.02 INSTALLATION

A. Where floor underlayment is used over occupied spaces below and hard surface flooring is scheduled to be applied, install acoustical underlayment over wood subfloor as specified in Section 09 60 13.

B. Install gypsum concrete floor underlayment in accordance with manufacturer's specifications and instructions applicable to conditions encountered, and as specified.

C. Install, spread, and screed to a smooth surface.

D. Place as continuously as possible so that the underlayment is not placed against adjacent underlayment that has obtained its initial set.

E. Drying: Maintain correct environmental conditions to keep the building clean and dry and protect against infestation of moisture from a variety of potential sources. Furnish mechanical ventilation and heat, if necessary, to remove moisture from the area until the gypsum cement underlayment is dry. Comply with additional specified requirements.

F. Cut felt barrier and perimeter isolation barrier flush with the top of gypsum concrete floor underlayment.

G. Comply with manufacturer's recommendations for subsequently applied direct glue-down flooring materials, including priming overspray as recommended.

H. Apply sealer to gypsum concrete floor underlayment where adhesive-applied floor coverings are to be installed in accordance with manufacturer’s instructions.

3.03 COMPLETION

A. When complete, the underlayment shall be finished to a reasonably smooth and uniform condition, and be free from pin holes, gouges, cuts, and other damage or defects.

B. Transition between the finish surfaces of underlayment and adjacent existing flooring shall be free from offsets.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing metal fabrications made from steel shapes, plates, bars, strips, tubes, pipes and castings not a part of structural steel or specified in other Sections, including but not limited to the following items:

1. Miscellaneous steel framing for partition support.

2. Angle corner guards and edge guards; painted and galvanized.

3. Handrail brackets.

4. Countertop support brackets.

5. Guardrails, railings, and handrails.

6. Elevator guide rail support brackets.

7. Stair nosings.

8. Supports for entry canopy.

9. Miscellaneous angles, plates, bars, rods, and other items not specified in other Sections but shown or required to complete the work.

B. Related Sections:

1. Metal stairs are specified in Section 05 51 00.

2. Metal ladders are specified in Section 05 51 33.

3. Painting is specified in Section 09 91 00.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. Guardrails, Railings and Handrails: Design, engineer, fabricate and install guardrails, railings, and handrails to withstand the following structural loads:

1. Top Rail of Railing System: Capable of withstanding a lateral load of 50-psf applied horizontally at right angles to the top rail.

2. Handrails: Capable of withstanding a load of 200-psf applied at any direction and point along the handrail.

3. Handrails and Railings shall comply with ADA requirements.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Include information on stair treads, paint products, and grout.

C. Shop Drawings: Include plans, elevations and details of metal fabrications and their connections. Show anchorage and accessory items. Furnish templates for anchors and bolts installed under other Sections.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications like that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1, D1.2, and D1.3 as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

1.05 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule to avoid delay of work.

1.06 SEQUENCING AND SCHEDULING

A. Mount handrails only on wall assemblies reinforced to receive anchors, and where the location of concealed anchor plates has been marked for the installer.

B. Painting: Items specified in this Section as having a shop applied prime coat will be job painted as specified in Section 09 91 00, unless otherwise noted.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. General: For fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501.

D. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1.

E. Galvanized Structural Steel Sheet: ASTM A653, galvanized in accordance with ASTM A525, G90 coating designation.

F. Steel Pipe: ASTM A53; type and grade selected by fabricator; black finish unless galvanizing is indicated or specified; standard weight, schedule 40, unless otherwise indicated.

G. Gray Iron Castings: ASTM A48, Class 30.

H. Malleable Iron Castings: ASTM A47, grade selected by fabricator.

2.02 ALUMINUM

A. Extrusions: ASTM B221, alloy 6063-T6.

B. Sheet: ASTM B209, alloy 5005-H15.

C. Bars, Rods and Wires: ASTM B211.

D. Drawn Seamless Tubing: ASTM B210.

E. Castings: ASTM B26 or B108, alloy 214 unless otherwise recommended by aluminum producer or finisher.

2.03 STAINLESS STEEL

A. Tubing: ASTM A554, grade MT 304.

B. Pipe: ASTM A312, grade TP304.

C. Castings: ASTM A743, Grade CF 8 or CF 20.

D. Plate: ASTM A167, type 304.

E. Finish: No. 4 satin polish finish matching approved sample.

2.04 FASTENERS

A. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and flat washers.

B. Machine Screws: ANSI B18.6.3.

C. Lag Bolts: ANSI B18.2.1.

D. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

E. Plain Washers: Round, carbon steel, ANSI B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, determined in accordance with ASTM E448.

2.05 GROUT

A. Non-Shrink Non-Metallic Grout: Euclid Chemical Co. "Euco N-S Grout", L&M Construction Chemicals, Inc. "Crystex", Master Builders Technologies, Inc. "Masterflow 928 and 713" or approved equal.

2.06 PAINT

A. Metal Primer: SSPC 20, Type 2; VOC-compliant.

1. Exposed to view items to be field painted shall be primed with a primer compatible with final finish coats specified in Section 09 91 00.

B. Galvanizing Repair Paint: VOC-compliant, high zinc dust content paint for re-galvanizing welds in galvanized steel; Rust-Oleum Corp. "Zinc-Rich Cold Galvanizing Compound", Tnemec 90-93, ZRC Worldwide "Galvalite" or approved equal.

2.07 MANUFACTURED ITEMS

A. Stair Nosings at Metal Pan Stairs: American Safety Tread Co., Inc. Type 9511, Wooster Products, Inc. "Spectra" Type WP3J or approved equal, color as selected by the Architect. Provide contrasting color at top and bottom of interior treads.

2.08 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.

2. Work to dimensions indicated,

3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

4. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated.

5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

6. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smoothly and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished work.

7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat- head countersunk screws or bolts for exposed fasteners unless tamperproof security screws are indicated.

8. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide zinc coating for all exterior items exposed to the elements, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and un-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.

C. Fabricate joints exposed to the weather to exclude water or provide weep holes.

D. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust, and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SP-3, or SP-7.

3. Remove oil, grease, and similar contaminants in accordance with SP-1.

4. Brush or spray on primer in accordance with manufacturer's instructions, at a rate of 2.0-mils thickness for each coat.

5. Apply one shop coat to fabricated metal items, except apply 2-coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.

6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 09 91 00.

7. Apply a heavy coat of bituminous paint, compounded for application in 30-mil coat, to metal surfaces in contact with concrete, masonry, and dissimilar metals. Do not apply on exposed surfaces.

2.09 MISCELLANEOUS METAL FABRICATIONS

A. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete work.

2. Fabricate to sizes, shapes and profiles shown or required.

3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.

4. Cut, drill, and tap units to receive hardware and similar items.

5. Furnish integrally welded anchors for casting into concrete or building into masonry.

6. Finish: Galvanize exterior frames and supports, shop prime interior frames and supports.

B. Steel Guardrails, Railings and Handrails: Fabricate to design, dimensions and details indicated. Railings and handrails shall comply with ADA requirements.

1. Interconnect railing and handrail members by butt welding or welding with internal connectors.

2. Provide coped joints at tee and cross sections.

3. Form simple and compound curves by bending tubing in jigs to produce uniform curvature for each repetitive configuration. Maintain cylindrical cross-section of tube throughout entire bend without buckling, twisting, or deforming exposed surfaces.

4. Provide wall returns at ends of wall-mounted handrails.

5. Close exposed ends of tubing by welding 3/16-inch steel plate in place or by using prefabricated fittings.

6. Flanges, Fittings and Anchors: Provide end closures, flanges, miscellaneous fittings, and anchors for interconnections of tubing and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry.

7. Finish: Galvanize exterior steel guardrails, railings, and handrails, including tubing, fittings, brackets, fasteners, and other ferrous components. Provide shop-primed metal for interior guardrails, railings, and handrails. Guardrails, railings, and handrails will be field painted as specified in Section 09 91 00.

C. Stair Railings and Handrails: Comply with specified requirements for steel tube railings and handrails. Connect railing posts to stair framing by welding. The maximum handrail member size shall be 1-1/2-inch O.D. Railings and handrails shall comply with ADA requirements. Provide expanded metal mesh railing panels where indicated. Stair railings and handrails will be field painted as specified in Section 09 91 00.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.02 INSTALLATION

A. General:

1. Fastening to in-Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

2. Cutting, Fitting and Placement:

a. Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications.

b. Set work accurately in location, alignment, and elevation, plumb, level, true and free of rack, measured from established lines and levels.

c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

3. Fit exposed connections together forming tight hairline joints.

a. Weld connections not shop-welded.

b. Grind exposed joints smooth and imperceptible, and touch-up shop paint coat.

c. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS for procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

5. Install prefabricated items in accordance with manufacturers' instructions.

B. Steel Guardrails, Railings and Handrails:

1. Adjust railings prior to anchoring to ensure matching alignment at abutting joints.

2. Space posts as indicated.

3. Plumb posts in each direction.

4. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts are inserted in sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.

5. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.

6. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.

7. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to structural steel members.

8. Secure handrails to wall with wall brackets and end fittings.

a. Locate brackets as indicated.

b. Secure wall brackets in accordance with manufacturer's instructions.

9. Expansion Joints: Provide at intervals not exceeding 40-feet. Provide slip joint with internal sleeve extending 2-inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6-inches of posts.

3.03 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0-mils.

B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and spot prime with specified primer applied to a minimum dry film thickness of 2.5-mils.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Metal stairs and intermediate landings with concrete filled pans.

B. Related Sections:

1. Cast-in-place concrete is specified in Section 03 30 00.

2. Metal fabrications are specified in Section 05 50 00.

3. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Include information on materials, components, fabrication, and installation instructions.

C. Shop Drawings: Include layout and erection drawings, including setting and template drawings for items built into the structure. Show splices and attachments for railings.

D. Engineering Calculations: Furnish calculations substantiating that work complies with design criteria and required structural and safety requirements and ADA requirements. Calculations shall be prepared and signed by a professional engineer licensed in the State of Arizona.

1.03 QUALITY ASSURANCE

A. Fabricator: Regularly providing metal stairs of type required for not less than 5-years.

B. Structural Design: Fabricator shall provide structural engineering design and calculations for metal stairs, developed, and signed by a professional engineer licensed in the State of Arizona.

1. Stairs and platforms shall support a minimum uniform live load of 100-psf with a safety factor as required by code and individual stair treads shall support a 300-pound concentrated load placed in a position which would cause maximum stress.

2. Lateral Load: 25-percent of live load plus dead load of stair. Maximum lateral deflection 1/8-inch horizontal displacement.

C. Welders performing welding on stairs shall be qualified in conformance with AWS D1.1.

D. Installer shall have a minimum of 2-years' experience in the satisfactory installation of metal stairs.

1.04 COORDINATION

A. Metal stair surfaces furnished to the Project site primed or galvanized and not scheduled or indicated to be covered by an applied floor covering will be painted as specified in Section 09 91 00.

B. Specified primer shall be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Section 09 91 00.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: For surfaces exposed to view, use materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Structural Steel Sheet: ASTM A570, hot-rolled; or ASTM A611, Class 1, cold-rolled, Grade A.

D. Galvanized Structural Steel Sheet: ASTM A446, G90, Grade A.

E. Gray Iron Castings: ASTM A48, Class 30.

F. Malleable Iron Castings: ASTM A47, grade selected by fabricator.

G. Brackets, Flanges and Anchors: Cast or formed metal of the same type of material and finish as supported stairs.

H. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.

I. Fasteners:

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.

3. Plain Washers: Round, carbon steel, FS FF-W-92.

4. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

J. Paint:

1. Metal Primer Paint: SSPC Paint 2.

2. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel.

2.02 FABRICATION, GENERAL

A. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

1. Ease exposed edges to a radius of approximately 1/32-inch unless otherwise indicated.

2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

B. Weld corners and seams continuously, complying with AWS recommendations. Grind exposed welds smooth, flush, and imperceptible to match and blend with adjoining surfaces.

C. Galvanizing: Provide a zinc coating for exterior metal stair components and those items indicated or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars and strip 0.0299-inch thick and heavier.

D. Shop Painting:

1. Shop paint metal stairs, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust, and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC SP-3, or SSPC SP-7.

3. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1.

4. Brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness of 2.0-mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

5. Apply one shop coat to fabricated metal items; apply 2-coats to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

6. Primer shall be smooth and suitable for application of finish paint specified in Section 09 91 00.

2.03 METAL STAIRS

A. General:

1. Construct stairs to conform to sizes and arrangements indicated; join pieces together by welding unless otherwise indicated.

2. Provide complete stair assemblies including metal framing, hangers, columns, struts, clips, brackets, bearing plates and other components necessary for support of stairs and platforms and to anchor the stairs on the supporting structure.

B. Stair Framing:

1. Fabricate stringers of structural members as indicated.

2. Provide closures for exposed ends of stringers.

3. Construct platforms of structural steel channel headers and miscellaneous framing members.

4. Bolt or weld headers to stringers, and framing members to stringers and headers; fabricate and join with concealed bolts.

C. Stairs with Concrete Filled Treads, Landings and Closed Risers:

1. Form metal pans of hot-rolled or cold-rolled carbon steel sheet.

2. Weld risers and sub-treads to stringers; locate welds on side of metal pans to be concealed by concrete fill.

3. Provide landings of configuration and construction of same metal as risers and treads, thicknesses required to support design loading. Attach landings to framing members with welds.

4. Finish interior stairs with shop-applied primer as specified.

5. Abrasive nosings are specified in Section 05 50 00.

D. Railings and handrails are specified in Section 05 50 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install metal stairs plumb and true to line in accordance with reviewed Shop Drawings.

B. Stair treads shall be uniformly spaced throughout each flight; treads and intermediate landings shall be level.

3.02 CLEANING

A. Following installation, clean metal stairs and leave them in a condition suitable for the installation of concrete fill in treads.

END OF SECTION

SECTION 05 51 33

METAL LADDERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for providing the following types of ladders:

1. Steel ladders at elevator pits.

B. Related Sections:

1. Metal fabrications are specified in Section 05 50 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications and installation instructions.

C. Shop Drawings: Include plans, elevations, sections and details of components and connections.

1.03 QUALITY ASSURANCE

A. Ladders shall comply with OSHA/ANSI A14.3 standards.

PART 2 - PRODUCTS

2.01 STEEL LADDERS

A. Comply with the requirements of ANSI A14.3, except as otherwise indicated.

B. Side Rails: 1/2-inch x 2-1/2-inch continuous structural steel flat bar with eased edges, spaced 18-inches apart.

C. Rungs: 3/4-inch solid structural steel bar, spaced 12-inches on center.

D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

E. Support at top and bottom and at intermediate points spaced not more than 5'-0" on center.

F. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7-inch clearance to centerline of rungs.

G. Extend rails 42-inches above top rung and return rails to wall or structure unless other secure handholds are provided.

H. If adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure.

I. Provide non-slip surface on the top of each rung.

J. Finish:

1. Interior Ladders: Shop primed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fastening to in-Place Construction: Provide anchorage devices and fasteners for securing to in-place construction.

B. Install ladders accurately in location, alignment, and elevation, and plumb.

END OF SECTION

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing interior architectural woodwork items including the following:

1. Millwork and trim.

2. Door frames and jambs.

3. Closet shelving.

B. Related Sections:

1. Flush wood doors are specified in Section 08 14 16.

2. Stile and rail wood doors are specified in Section 08 14 33.

3. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Shop Drawings: Show details of fabrication and installation, dimensioned plans, elevations, and sections.

1. Shop drawings shall comply with North American Architectural Woodwork Standards (NAAWS 4.0) Section 01 – Submittals for each type of interior architectural woodwork item required.

C. Samples:

1. Samples shall comply with NAAWS 04, Section 01.7.

2. Lumber products with or for transparent finish, 3-1/2-inch x 12-inch for each finish system and color. Provide multiple samples if required to represent the color and grain to be expected.

3. Corner pieces of miter joints for standing trim.

D. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other specified information.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork like that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

C. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet specified requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Product woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

C. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet specified requirements.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.

1.07 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Fabricated woodwork shall be left in a well-ventilated warehouse for a minimum of 72-hours prior to delivery to the Project site.

1.08 INDOOR AIR QUALITY

A. Do not use wood products containing urea formaldehyde glues inside the shell of the building.

B. When machining plastic products, protect surrounding areas from dust.

1.09 WARRANTY

A. Warrant interior architectural woodwork to be of good material and workmanship and free from defects that render it unserviceable for which it is intended, for a period of 5-years from date of Substantial Completion. Natural variations in the color or texture of the wood are not considered defects. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of the NAAWS for each type of woodwork and NAAWS 4.0 quality grade specified.

B. Lumber Standards: Comply with PS 20 for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

C. Sheet Products: Comply with NAAWS 4.0 Section 04 and the following depending on the type of sheet product used. Balance sheet shall be same wood veneer as face. Core material shall be one of the following at Contractor's option unless specific core requirements are indicated or specified.

1. Plywood Standards: Comply with PS 1 or APA PRP-108. Plywood products shall contain no added urea-formaldehyde as a binder.

2. Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

3. Medium Density Fiberboard Trim: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

D. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber kiln-dried to less than 15-percent moisture content.

E. Screws: Material, type, size, and finish required for each use.

F. Nails: Material, type, size, and finish required for each use.

G. Anchors: Material, type, size, and finish required for each substrate for secure anchorage.

H. Glue: VOC compliant type as recommended by manufacturer for general carpentry use.

I. Adhesives: VOC-compliant type as recommended by manufacturer.

2.02 FABRICATION, GENERAL

A. Comply with NAAWS 4.0 requirements for the grade specified.

B. Wood Moisture Content: Comply with requirements of referenced quality standards for moisture content of lumber in relation to relative humidity conditions existing at time of fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to a radius as follows:

1. Corners and edges of solid wood members less than 1-inch in nominal thickness: 1/16-inch.

2. Edges of rails and similar members more than 1-inch in nominal thickness: 1/8-inch.

D. Complete fabrication, including assembly and finishing before shipment to Project site to maximum extent possible. Disassemble components only as required for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop-cut openings to maximum extent possible. Locate openings accurately and use templates for roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges and cutouts.

2.03 MILLWORK AND TRIM FOR TRANSPARENT FINISH

A. Standard: Comply with NAAWS 4.0 Section 06.

B. NAAWS 4.0 Grade: Premium.

C. Back-out or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

D. Lumber Species and Cut: To be selected by the Architect.

E. Finish: Prefinished as specified.

2.04 MILLWORK AND TRIM FOR OPAQUE FINISH

A. Standard: Comply with NAAWS 4.0 Section 06.

B. NAAWS 4.0 Grade: Custom.

C. Back-out or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

D. Lumber Species: Close grain hardwood at fabricator's option.

E. Finish: Field-applied as specified in Section 09 91 00.

2.05 FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Standard: Comply with NAAWS 4.0 Section 06.

B. Grade: Premium.

C. Lumber Species and Cut: To be selected by the Architect.

D. Construct frames with plowed stops.

E. Finish: Prefinished as specified.

2.06 FRAMES AND JAMBS FOR OPAQUE FINISH

A. Standard: Comply with NAAWS 4.0 Section 06.

B. Grade: Custom.

C. Lumber Species: Pine, Hemlock or Douglas Fir.

D. Construct frames with plowed or applied stops.

E. Finish: Field-applied as specified in Section 09 91 00.

2.07 CLOSET SHELVING

A. Shelves: Timber Products Company "Encore" or approved equal particleboard backing certified to California (CARB) Airborne Toxic Control Measure (ATCM) 93120, Phase 2 emission limits with white Melamine facing on both faces and all edges.

B. Shelf Supports: Taymor, Stanley, Knape & Vogt or approved equal metal shelf and rod support.

C. Closet Rod: 1-3/8-inch diameter polished chrome.

D. Pole Socket: Taymor 2820, Stanley, Knape & Vogt or approved equal.

2.08 FLUS WOOD WALL AND CEILING PANELS FOR TRANSPARENT FINISH

A. Standard: NAAWS 04 Section 08.

B. Grade: Premium.

C. Veneer Species and Cut: To be selected by the Architect.

D. Matching of Adjacent Veneer Leaves: Book match.

E. Veneer Matching within Panel Face: Balance match.

F. Panel-Matching Method: Match panels within each separate area by sequence-matched, uniform-size sets.

G. Vertical Panel-Matching Method: End match.

H. Core: Fire-rated, ultra-low emitting formaldehyde (ULEF or NAUF), medium density fiberboard that has been tested for compatibility of adhesives and wood veneers without veneer discoloration.

I. Finish: Prefinished as specified.

2.09 SHOP-FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparation of architectural woodwork.

B. Standard: NAAWS 04 Section 05.

C. Transparent Finish for Closed-Grain Woods:

1. NAAWS 4.0 Grade: Premium.

2. NAAWS 4.0 Finish System 12: Polyurethan, Water-Based.

3. Wash Coat: Reduced vinyl sealer at stained finish.

4. Stain: Match approved sample for color.

5. Sealer: Vinyl.

6. Finish: Two topcoats in sheen to match approved sample.

D. Transparent Finish for Open-Grain Woods:

1. NAAWS 4.0 Grade: Premium.

2. NAAWS 4.0 Finish System 12: Polyurethan, Water-Based.

3. Wash Coat: Reduced vinyl sealer at stained finish.

4. Stain: Match approved sample for color.

5. Filler.

6. Finish: Two topcoats in sheen to match approved sample.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

A. General: Install interior architectural woodwork in accordance with NAAWS 4.0 Section 14 for same grade specified for woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8-inch in 8'-0" for plumb and level. Comply with additional requirements of NAAWS 4.0 Section 15.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Millwork and Trim: Install with minimum number of joints possible, using full-length pieces to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

F. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated or if approved by the Architect. Install paneling with no more than 1/16-inch in 8’-0” horizontal variation from a true plane.

3.03 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer, to ensure woodwork is without damage or deterioration at time of final acceptance.

END OF SECTION

SECTION 06 64 00

PLASTIC PANELING (FRP)

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes fiberglass reinforced plastic (FRP) coated wall panels, trim, adhesive, and accessories.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Shop Drawings: Indicate panel layouts and seaming diagrams. Provide details at joints, transitions of panels and materials.

C. Product Data: Furnish literature for FRP system and installation instructions.

D. Samples: Furnish finish and color samples from manufacturer's full range of colors. Furnish two 12-inch-long samples of each type of trim.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage.

C. Maintain protective coverings in place and in good repair until removal is necessary.

D. Store products inside enclosed storage facilities or closed building, supported above grade and slabs-on-grade.

E. Maintain storage spaces and products in dry condition within temperature extremes recommended by manufacturer.

F. Follow special instructions of manufacturer.

1.04 PROJECT CONDITIONS

A. Do not begin installation until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture has dissipated.

B. Maintain ambient temperature and relative humidity within limits required by type of adhesive used and recommendations of adhesive manufacturer.

C. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

PART 2 - PRODUCTS

2.01 PLASTIC PANELING (FRP)

A. Approved Manufacturers: Crane Composites “KEMLITE Fire-X Glasbord" or “Sequentia Flat”, NUDO “FiberLite”, Sequentia "Structoglas", Marlite “Regular” or approved equal.

B. Texture: As selected by the Architect from manufacturer’s standards.

C. Thickness: Manufacturer’s standard for selected texture.

D. Color: As selected by the Architect.

E. Flame Spread: 25 or less, ASTM E84.

F. Smoke Developed: 450 or less, ASTM E84.

G. Panels shall exhibit no more than a 0.038-percent weight loss after a 25-cycle Taber Abrasion Test.

2.02 MISCELLANEOUS MATERIALS

A. Adhesive: VOC-compliant waterproof adhesive as recommended by panel manufacturer for installation conditions.

B. Moldings: PVC. Provide inside corners, outside corners, edging, division strips, and base molding.

C. Sealant: As specified in Section 07 92 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panels in accordance with panel manufacturer's instructions using moldings and adhesive. Install panels with manufacturer’s recommended gap for panel field and corner joints.

B. Before installing panels in moldings, fill grooves in moldings with silicone sanitary sealant specified in Section 07 92 00.

3.02 COMPLETION

A. When complete, panels shall be securely adhered to substrates and moldings shall be plumb and level.

B. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, fingerprints, and other defects and damage.

END OF SECTION

SECTION 07 13 53

ELASTOMERIC SHEET WATERPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing elastomeric sheet waterproofing at the following locations:

1. Under mortar bed at shower floors.

B. Related Sections:

1. Elastomeric liquid waterproofing is specified in Section 07 14 17.

2. Tile is specified in Section 09 30 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications, installation instructions, and general recommendations for each waterproofing material. Include data substantiating compliance with specified requirements.

C. Warranty.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 3-years' experience in the installation of waterproofing of the type specified and approved by the manufacturer of the waterproofing materials.

B. Pre-Installation Conference: A pre-installation conference will be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, trades having work within, adjacent, over or under the work of this Section, Architect, and system manufacturer's field representative. Agenda for meetings shall include but not be limited to the following:

1. Review of submittals.

2. Review of surface preparation, minimum curing period and installation procedures.

3. Review of details and flashings.

4. Sequence of construction, responsibilities, and schedule for subsequent operations.

5. Review of mock-up requirements.

6. Review of inspection, testing, protection, and repair procedures.

1.04 JOB CONDITIONS

A. Substrate: Proceed with waterproofing work only after substrate construction and penetrating work have been completed.

B. Ventilation: Provide adequate ventilation to prevent accumulations of hazardous fumes during application of solvent-based components in enclosed spaces and maintain ventilation until coatings have cured.

1.05 WARRANTY

A. Warrant elastomeric sheet waterproofing to be free from defects in materials and workmanship for a period of 3-years from date of Substantial Completion. Warranty shall include removal and replacement of materials installed over elastomeric sheet waterproofing, including but not limited to mortar setting bed and tile. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 ELASTOMERIC SHEET WATERPROOFING MATERIALS

A. Sheet Membrane: Noble Company "Chloraloy 240" heavy-duty non-plasticized CPE synthetic elastomeric, 1mm (0.048-inch) nominal thickness or approved equal.

B. Seam Cement: CPE solvent welding liquid, Xylene, or as recommended by sheet membrane manufacturer.

C. Adhesive and Sealant: Noble Company “NobleSealant 150” or as recommended by sheet membrane manufacturer for seaming, caulking drains, and adhering sheet.

D. Preformed outside Corners: Noble Company “Inside Corners” and “Dam/Outside Corners” or as recommended by sheet membrane manufacturer for forming outside corners.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

B. Concrete surfaces shall be smooth, clean, and free from dirt and grease.

3.02 INSTALLATION

A. Comply with manufacturer's installation instructions using the fully adhered method of installation.

B. Precut membrane allowing for overlap at seams and upturn at walls.

C. Form seams by either lapping membrane 3-inches at ends and sides, or by butting membrane sheets together and covering with a 6-inch-wide cap. Lap joints in the direction of watershed. Clean lap and splice areas as recommended by membrane manufacturer prior to applying welding agent.

D. Extend membrane up walls a minimum of 6-inches above finished tile surface at wall.

E. Secure membrane to walls with sheet metal screws and washers 1/2-inch from top edge or use adhesive over solid backing. Where metal studs are used and no back-up is provided, secure to studs with sheet metal screws and washers. Fold material over 1-inch at the top and fasten to backing and studs.

F. Extended membrane into floor drain clamping rings. Apply heavy bead of sealant under sheet at clamping ring.

3.03 WATER TESTING

A. Upon completion of work, test for leaks by plugging the drain or damming areas and filling with 3-inches of water. Allow water to stand for 24-hours and inspect for leakage. Make necessary adjustments to stop leakage and retest until watertight.

3.04 PROTECTION

A. Do not permit traffic on completed membrane prior to application of surface material.

END OF SECTION

SECTION 07 14 00

COLD-FLUID APPLIED WATERPROOFING

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes single-component, cold-applied, moisture-cured, liquid waterproofing membrane on existing below grade walls where indicated.

B. Related Sections:

1. Elastomeric liquid waterproofing is specified in Section 07 14 17.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Submit manufacturer's product data and application instructions.

C. Warranty.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of fluid applied waterproofing membranes.

B. Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.04 MOCK-UPS

A. Prior to installation of waterproofing membrane, apply waterproofing membrane to 100-sq. ft. of wall to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution.

B. Cooperate and coordinate with the owner's inspection and testing agency. Do not cover any installed waterproofing membrane unless it has been inspected, tested and approved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

C. Store materials in a clean, dry area in accordance with manufacturer's instructions.

D. Store at temperatures between 40° - 70° F.

E. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not apply membrane when air, material, or surface temperatures are expected to fall below 30° F within 4-hours of completed application.

B. Do not apply membrane if rainfall is forecast or imminent within 12-hours.

C. Do not apply waterproofing membrane to any surfaces containing frost.

D. Consult manufacturer for applications to green concrete.

1.07 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site approximately 2-weeks prior to scheduled commencement of waterproofing installation and after approval of a complete submittal. Foremen from each trade involved in system installation shall be present during conference.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

2. Installer, Architect, manufacturer's technical representative, and other installers whose work penetrates or interfaces with waterproofing or may affect its quality shall meet at the project site to coordinate related requirements and waterproofing work.

1.08 WARRANTY

A. Warrant cold fluid-applied waterproofing to be free from defects in materials and workmanship for a period of 10-years from date of Substantial Completion. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. W.R. Meadows, Inc. "Hydralastic 836" or approved equal.

2.02 MATERIALS

A. Waterproofing Membrane: Single-component, cold-applied, solvent-free, non-shrink, liquid waterproofing membrane having the following properties determined by laboratory testing:

1. Solids content by weight, ASTM C1250: 98-percent.

2. Tensile Strength, ASTM D412: 100-psi.

3. Elongation at break, ASTM D412: 425-percent.

4. Water Vapor Transmission, ASTM E96 (Method BW): 0.1-perms.

5. Shore 00 Hardness, ASTM D2240: 57.

6. VOC, ASTM D2369: 36 g/L

2.03 ACCESSORIES

A. Joint Tape: W.R. Meadows “Reinforcing Fabric HCR”, 6-inch-wide reinforcing fabric for corners, crack, and joint treatment.

B. Reinforcing Fabric for High Build Applications: W.R. Meadows “Reinforcing Fabric HCR”.

C. Reinforced Joint Tape for Outside Corners Subject to Backfill: W.R. Meadows “Precon Fabric Tape”.

D. Epoxy Primer: W.R. Meadows “Rezi-Weld LV” or “Rezi-Weld LV State”.

E. Detailing Membrane: W.R. Meadows “BEM”.

F. Concrete Repair Materials: W.R. Meadows “Meadow-Patch 5” and “Meadow Patch-20”.

G. Waterproofing Protection Course: W.R. Meadows “Perminator 15 mil” or “Protection Course”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Cure concrete using the wet cure method. If a curing compound is used, mechanically remove from the concrete surface. Lightly trowel or screed concrete to provide a flat, uniform surface. Finish surface providing a light broom finish.

D. Power wash or use oil-free compressed air to remove contaminants that may interfere with the bond of the membrane.

E. Mechanically abrade the concrete surface by grinding, abrasive blasting, or shot blasting according to manufacturer’s instructions to provide an acceptable surface profile.

F. Shot blast the surface to complete the surface preparation.

G. Patch holes and voids and smooth out any surface misalignments.

H. Do not apply waterproofing to surfaces unacceptable to manufacturer.

I. Priming:

1. Condition components to 60- to 85-deg. F. for 24-hours prior to use. Premix each component.

2. Mechanically mix at slow speed to completely mix the epoxy primer.

3. Apply the low viscosity epoxy with a nap roller or squeegee at a coverage rate of 100-sq. ft. per gallon providing a uniform coverage over the substrate.

4. Allow the epoxy primer to become tack-free prior to the application of the fluid applied waterproofing membrane.

J. Mixing:

1. Condition material at 75-deg. F. for at least 12-hours prior to use.

2. Apply up to one quart of water to 5-gallons of membrane.

3. Mix for 3-minutes using a mechanical mixer at slow speed to ensure a homogeneous material.

K. Treatment of Existing Cracks and Non-Structural Joints:

1. Identify and install detailing membrane in cracks and non-structural joints.

2. Apply a 30 wet mil coat of the fluid applied membrane ensuring there is a minimum of 3-inch of membrane extending onto the wall in all directions.

3. Embed the non-woven reinforcing fabric over the entire area of this membrane and work in using trowel.

4. Completely cover the glass mesh with a second coat of the fluid applied membrane at 30 wet mils while the first coat is still wet, extending 3-inches onto the wall in all directions.

L. Treatment of Inside and Outside Corners:

1. Install detailing membrane to create a minimum ¾-inch fillet in inside corners.

2. Apply a 30 wet mil coat of the fluid applied membrane ensuring that there is a minimum of 3-inches of membrane extending onto the wall in all directions.

3. Embed the non-woven reinforcing fabric over the entire area of this membrane and work in using trowel.

4. Completely cover the glass mesh with a second coat of fluid applied membrane at 30 wet mils while the first coat is still wet, extending 3-inches onto the wall in all directions.

5. On outside corners subject to backfilling, install reinforced joint tape in lieu of fabric joint tape following the same procedure.

3.03 APPLICATION

A. Apply waterproofing membrane system in accordance with manufacturer's instructions.

B. Gently mix membrane prior to application.

C. Apply membrane by trowel, flat-blade squeegee, or roller, at a minimum coverage rate of 25-ft.^{2}/gal, providing a thickness of 60 wet mils.

D. Fully embed the reinforcing fabric into this first coat.

E. Apply second coat as soon as first coat has set sufficiently to support the second coat at a coverage rate of 60 wet mils.

F. Inspect surface area to ensure proper adhesion and consistent thickness is achieved.

G. Work material into any fluted rib forming indentations.

H. Provide minimum cured membrane thickness of 120 mils dry.

3.04 PROTECTION

A. Protect membrane with application of waterproofing protection course, drainage board, or other approved material.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

SECTION 07 14 17

ELASTOMERIC LIQUID WATERPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing cold fluid-applied waterproofing at the following locations:

1. Under interior thin-set floor tile at showers.

2. Under thin-set wall tile at showers.

B. Related Sections:

1. Cementitious backing boards are specified in Section 09 82 13.

2. Tile is specified in Section 09 30 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications, installation instructions, and general recommendations for each waterproofing material. Include data substantiating compliance with specified requirements.

C. Warranty.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Documented experience in the installation of waterproofing systems of the type specified and approved by the manufacturer of the waterproofing materials.

B. Waterproofing membrane shall meet or exceed extra heavy-duty rating when tested in accordance with ASTM C627.

C. Pre-Installation Conference: A pre-installation conference will be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, trades having work within, adjacent, over or under the work of this Section, Architect, and system manufacturer’s field representative. Agenda for meetings shall include but not be limited to the following:

1. Review of submittals.

2. Review of surface preparation, minimum curing period and installation procedures.

3. Review of details and flashings.

4. Sequence of construction, responsibilities, and schedule for subsequent operations.

5. Review of mock-up requirements.

6. Review of inspection, testing, protection, and repair procedures.

1.04 JOB CONDITIONS

A. Substrate: Proceed with waterproofing work only after substrate construction and penetrating work have been completed.

B. Coordinate finishing and curing of concrete surfaces to receive waterproofing with work of Section 03 30 00. Concrete surfaces shall have a steel trowel finish and shall be covered and wet cured for a minimum of 7-days.

C. Weather: Proceed with waterproofing work when existing and forecasted conditions will permit work to be performed in accordance with manufacturer's instructions.

D. Ventilation: Provide adequate ventilation to prevent accumulations of hazardous fumes during application of solvent-based components in enclosed spaces and maintain ventilation until coatings have cured.

1.05 WARRANTY

A. Warrant elastomeric liquid waterproofing to be free from defects in materials and workmanship for a period of 10-years from Date of Substantial Completion. This warranty shall include the cost to replace covering materials applied over elastomeric liquid waterproofing. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Laticrete International "Hydroban" ICC ESR-2417, Parex USA / Merkete “Hydro Guard SP1 Waterproof Membrane and Anti-Fracture Membrane" ICC ESR-2619-PMG, Noble Company “NobleSeal TS” ICC PMG-1059 or approved equal.

2.02 MATERIALS

A. Membrane: Cold-applied liquid rubber latex with fabric reinforcement.

B. Reinforcing: Rot-proof fabric, designed by membrane manufacturer for use in reinforcing membrane.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of membrane manufacturer.

B. Rough or uneven surfaces shall be made smooth or leveled with underlayment material in accordance with manufacturer's recommendations.

C. Concrete surfaces shall be smooth, clean, free from dirt, grease, concrete sealers or curing compounds.

D. Dry, dusty slabs shall be dampened and swept off.

E. Do not allow waterproofing materials to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking.

3.02 INSTALLATION

A. Comply with ANSI A108.1, ANSI A108.13 and manufacturer's instructions.

B. Precut reinforcing fabric allowing 2-inches for overlap at ends and sides. Extend fabric 6-inches through door openings.

C. Reinforce Joints: Spread a layer of waterproofing liquid at joints and cracks. Embed a 6-inch-wide strip of reinforcing fabric into the liquid. Spread a layer of waterproofing liquid over the fabric to seal it.

D. Coves: Spread a layer of waterproofing liquid in coves, imbed fabric and allow 6-inches of the fabric to flash up to walls. Spread a coat of liquid over the fabric to seal it. Flash the fabric and waterproofing liquid into drains and around projections.

E. Cracks: Clean and fill cracks greater than 1/16-inch with a scratch coat of latex portland cement mortar and allow to cure. Spread a layer of waterproofing liquid on crack, imbed a 6-inch strip of reinforcing fabric into the liquid, and spread a coat of liquid over the fabric to seal it.

F. Using a paint roller or brush, apply a coat of liquid membrane to the floor and/or wall, slightly wider than the fabric width. Include joints and coves previously reinforced. While the surface is still wet, embed fabric and smooth out wrinkles and press with brush or roller until membrane bleeds through to surface.

G. Apply liquid membrane to completely cover the fabric and allow to dry to the touch.

H. Apply an additional coat of liquid membrane and allow to dry.

I. Inspect final surface for pinholes, voids, or thin spots. Use additional membrane liquid to seal any defects.

3.03 PROTECTION

A. Do not permit traffic on completed membrane prior to application of surfacing material.

END OF SECTION

SECTION 07 21 14

ENGINEERED INSULATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Engineered Insulated ribbed foam panel system incorporating a drainage plane, wiring and utility chases, and molded-in attachment studs.

1.02 SUBMITTALS

A. General: Comply with the requirements specified in Section 01 33 00.

B. Product Data: Submit data on product characteristics, system performance criteria, limitations, adhesives, and attachment devices.

C. Manufacturer's Installation Instructions: Submit special environmental conditions required for installation, and installation techniques.

1.03 QUALITY ASSURANCE

A. National Fire Protection Association:

1. NFPA 286: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

B. International Building Code: IBC Section 803.10 Stability.

C. International Code Council: ICC – ES Acceptance Criteria for Quality Documentation (AC10).

D. Insulation Installed in Concealed Locations Surface Burning Characteristics:

1. Flame Spread Rating: 25 or less.

2. Smoke Developed Index: 450 or less.

E. Interior Wall insulation shall not be produced with, or contain, any of the United States EPA regulated CFC compounds listed in the Montreal Protocol of the United Nations Environmental Program.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives when temperature or weather conditions are detrimental to successful installation. Refer to manufacturer's product information for recommended temperatures and conditions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver panels to project in original packaging, clearly labeled with identification of manufacturer and product name visible.

C. Store panels in original packaging on shipping pallets. Store loose panels on flat surface to prevent sagging or warping. Protect from weather, moisture, and soiling. Do not store in sealed containers.

D. Handle panels carefully so that corners are not broken off or otherwise damaged.

E. Ensure that ultra-violet protection is provided for material, should on-site storage extend beyond 30 days.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURER

A. InSoFast, LLC or approved equal.

2.02 PANEL DESCRIPTION

A. Foam Panels: Below grade fire-retardant closed-cell ribbed foam board. Type III vapor retarder preventing mold growth. R-value = 4.45 per inch.

B. Attachment Studs: 100 percent recycled co-polymer polypropylene fully flush with panels.

C. Edges: Tongue and Groove.

D. Chaseways: Wiring chases running vertically at 16 inches on center and horizontally at 24 inches on center for each panel. Design as required by Electrical code.

E. Gluing Surface: Ribbed surface to allow compliant wall adhesion.

F. Attachment Points: Three recessed attachment points located 6 inches o.c. along the stud for mechanically fastened projects.

2.03 PANEL CONSTRUCTION

A. Molded closed-cell ribbed EPS foam with fire retardant and embedded fully insulated studs positioned at 16 inches o.c.

1. Size: 48 inches wide x 24 inches high.

2. Thickness: 2 inches.

2.04 ACCESSORIES

A. Adhesive: Type recommended by system manufacturer for application.

B. Fasteners: Type recommended by system manufacturer for application.

1. Concrete Screws: Tapcon® or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify substrate, and adjacent materials are dry and ready to receive insulation and adhesive.

B. Verify substrate surface is flat, free of fins, irregularities, materials or substances affecting adhesive bond.

3.02 SITE VERIFICATION OF CONDITIONS

A. Examine wall surface for compliance with requirements for installation tolerances and other conditions. Dryer climates may require misting of walls with potable water.

B. Examine floor for levelness. If floor is not level make necessary adjustments to insure panels are installed level across the floor surface.

3.03 PREPARATION

A. Ensure that all wall and floor surfaces are free from soiling that could affect the adhesive bond when using the adhesive bonding method.

B. Remove excess concrete flashing that would be out of installation tolerances.

3.04 INSTALLATION

A. Begin installation at a corner.

B. Attach panel to substrate choosing the appropriate attachment method of adhesive bonding, mechanical attachment, or a combination of both.

1. Adhesive Bonding Method: Apply adhesive to ribbed bonding surfaces on back side of stud. Use adhesives recommended by insulation board manufacturer.

2. Mechanical Attachment Method:

a. Utilize, as required, recessed attachment points on surface of studs to avoid protruding fastener heads.

b. Follow fastener specifications, instructions for installation for proper spacing and size of fasteners.

C. Install panels in a running bond utilizing the tongue and groove connection.

D. Cut panels to fit around openings. Panels can be cut with long blade utility knife, reciprocating saw, saber saw, hand saw, or circular saw. Use additional adhesive directly on foam at corners and any cut around openings.

E. If additional attachment at corners or around openings is needed for drywall attachment, adhere metal corner bead or galvanized sheet metal angle to foam. This sub-corner reinforcing will aid in attachment of drywall and corner trim boards for interior and exterior cladding or other covering.

F. Electrical Boxes and Conduit:

1. Existing electrical boxes, conduit, plumbing, and other protrusions:

a. Press panel against box or conduit.

b. Using the impression left on the backside of the panel, cut out foam to create a chase.

2. Installation of new wiring and boxes:

a. New wiring can be pulled through factory-formed chases when using flexible or armored wiring or cabling.

b. Boxes are cut into panel using long-blade utility knife or hot knife and fastened to substrate.

3. Electrical boxes shall be sealed to prevent moisture from penetrating boxes when utilizing the draining plane. Electrical boxes shall be sealed with expanding foam sealant above the box.

G. Periodically check panels for proper vertical and horizontal alignment.

3.05 CLEANUP

A. Remove and recycle or dispose of scraps of panels, packaging, and other materials associated with this installation.

END OF SECTION

SECTION 07 21 19

SPRAYED THERMAL INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Sprayed closed-cell insulation in attic areas where indicated.

B. Related Sections:

1. Engineered insulation system is specified in Section 07 21 14.

2. Roof board insulation is specified in Section 07 22 16.

3. Firestopping insulation is specified in Section 07 84 00.

4. Acoustic insulation is specified in Section 09 81 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's descriptive and technical data.

C. Samples: Duplicate sets of 8-inch x 10-inch panels with insulation applied to indicate color and finish texture.

1.03 QUALITY ASSURANCE

A. Applicator shall be approved by sprayed insulation manufacturer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in manufacturer's original unopened packages.

C. Store materials off ground, under cover, and away from damp surfaces.

PART 2 - PRODUCTS

2.01 CLOSED CELL SRPAYED FOAM INSULATION

A. Approved Manufacturers: Bayer MaterialScience “Bayseal CC” ICC-ESR 2072, CertainTeed “CertaSpray Closed Cell Foam” or approved equal.

B. Material: Medium-density, MDI-based polyurethane thermoset rigid foam.

C. Physical and Mechanical Properties:

1. Core Density: 1.9- to 2.4-pcf when tested in accordance with ASTM D1622.

2. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2-inches / 6.4 when greater than 2-1/2-inches when tested in accordance with ASTM C518 at 75-deg. F./BTU.

3. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C518 at 75-deg. F./BTU.

4. Closed Cell Content: 88- to 95-percent when tested in accordance with ASTM D2842.

5. Compressive Strength: Greater than 25-psi when tested in accordance with ASTM D1621.

6. Tensile Strength: 23-psi when tested in accordance with ASTM D1623.

7. Water Absorption: Less than 2-percent by volume when tested in accordance with ASTM D2842.

8. Dimensional Stability: Less than 9-percent by volume when tested in accordance with ASTM D2126 at 75-deg. F./95-percent RH, 28-day.

9. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E96.

10. Air Permeability: 0.013 when tested in accordance with ASTM E283 at 1-inch thickness.

11. Fungi Resistance: Pass, with no mold growth when tested in accordance with ASTM C1338.

D. Fire Performance:

1. Flame spread less than 25 when tested in accordance with ASTM E84.

2. Smoke less than 450 when tested in accordance with ASTM E84.

E. Thickness: As required for indicated R-values.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install sprayed insulation where indicated, as specified, and in accordance with the manufacturer's printed instructions.

B. Do not install insulation until concrete substrate is complete dry and cured.

C. Apply insulation to an average depth as specified.

D. When complete, finish surfaces shall be uniform in texture and color, and free from holes, thin spots, over-build, and other irregularities.

E. Adjacent surfaces shall be free from sprayed insulation.

END OF SECTION

SECTION 07 26 19

BELOW-GRADE VAPOR BARRIERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing vapor barrier and accessories under new concrete slabs-on-grade.

B. Related Sections:

1. Cast-in-place concrete is specified in Section 03 30 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Include independent laboratory test results showing compliance with ASTM and ACI Standards. Include manufacturer's installation instructions for placement, seaming, and pipe boot installation.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Protect products against damage during field handling and installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Vapor Barrier Sheeting: W.R. Meadows "Perminator HP" or approved equal.

1. Thickness: Not less than 15 mil.

2. Water Vapor Permeance Rating, ASTM E96, Water Method: <0.1 perms.

3. Tensile Strength, ASTM E154, Section 9: >45.0 lbf/inch.

4. Puncture Resistance, ASTM D1709, Method B: >2200 grams.

B. Seam Tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4-inches wide. Tape shall have a water vapor transmission rate of 0.3-perms or less in accordance with ASTM E96.

C. Mastic: As recommended by vapor barrier manufacturer. Mastic shall have a water vapor transmission rate of 0.3-perms or less in accordance with ASTM E96.

D. Pipe Boots: Construct from vapor barrier sheeting material and pressure sensitive tape in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 INSPECTION

A. Below-grade and grading work and items penetrating vapor barrier shall be complete prior to start of installation.

3.02 INSTALLATION REQUIREMENTS

A. Vapor Barrier Sheeting:

1. Install in accordance with manufacturer's instructions and ASTM E1643.

2. Unroll with the longest dimension parallel with the direction of the pour and face laps away from the expected direction of the placement whenever possible.

3. Lap vapor barrier over footings and seal to foundation walls.

4. Seal vapor barrier to slab perimeter/edge using specified seal and remove dirt, debris, and mud from seal material prior to concrete placement. Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.

5. Overlap joints 6-inches or greater if required by vapor barrier manufacturer and seal with pressure sensitive tape.

6. Seal penetrations, including pipes, with pipe boot.

   a. Single pipe penetrations may be sealed using pipe boot constructed from the product. Cut a piece of plastic 12-inches wide x 1-1/2 times the circumference of the pipe. With scissors, cut slits half the width of the film Wrap boot around pipe; tape onto pipe and completely tape the base to the vapor barrier.

   b. Multiple pipe penetrations in proximity and small pipes shall be sealed using mastic. Cut out a small area around pipes. Cut a patch of vapor barrier extending at least 6-inches past the cut out in all directions. Cut X's or small circles in the patch and install over pipes. Overlap at least 6-inches and tape. Build up 40- to 60-mils of mastic or as required to completely fill voids between the pipe and the vapor barrier.

7. Penetrations through vapor barrier sheeting except for reinforcing steel and permanent utilities are not permitted.

8. Repair damaged areas by cutting patches of vapor barrier sheeting, overlapping damaged area 6-inches, and taping all four sides with pressure sensitive tape.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing flashing and sheet metal.

B. Related Sections:

1. Thermoplastic-polyolefin roofing is specified in Section 07 54 23.

2. Self-adhering sheet flashing is specified in Section 07 65 26.

3. Painting is specified in Section 09 91 00.

1.02 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects. Completed sheet metal flashing and trim shall not rattle, leak, or loosen and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes of 120-deg. F. ambient and 180-deg. F. material surfaces.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product. Include construction details, material descriptions, dimension of components and profiles, and finishes for each manufactured product or accessory.

C. Samples: 8-inch square samples of specified sheet materials to be exposed as finished surfaces.

D. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location.

2. Details of forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips and other attachments. Include pattern of seams.

4. Details of termination points and assemblies, including fixed points.

5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.

6. Details of special conditions.

7. Details of connections to adjoining work.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim like that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA "Architectural Sheet Metal Manual" unless more stringent requirements are indicated or specified.

C. Pre-installation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer, installer, and installer whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing and trim.

5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

C. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent required for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Sheet Metal Thickness: The following table may be used to covert specified sheet metal thickness to gauges. Not all materials will be used in the Project.

Gauge No.	Aluminum	Stainless steel	Zinc-Tin Coated Stainless Steel	Galvanized	Aluminum-Zinc Coated Steel	Zinc
12	---	---	---	---	---	.028"
13	---	---	---	---	---	.032"
14	---	---	---	---	---	.036"
15	---	---	---	---	---	.040"
16	.063"	.063"	---	.064"	.064"	.045"
18	.050"	.050"	---	.052"	.052"	.055"
20	.040"	.038"	---	.040"	.040"	.070"
22	.034"	.031"	---	.034"	.034"	.090"
23	.032"	.028"	---	.031"	.031"	.100"
24	.028"	.025"	---	.028"	.028"	.125"

25	.024"	.022"	.024"	.025"	.025"	---
26	.022"	.019"	.018"	.022"	.022"	---
28	---	.016"	.015"	.019"	.019"	---

C. Copper Sheet: Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper, 16-oz. except as otherwise indicated.

1. Non-Patinated Exposed Finish: Mill.

D. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality.

2. Surface: Smooth, flat and mill phosphatized for field painting as specified in Section 09 91 00.

E. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304, dead soft, fully annealed, 2D finish, smooth flat surface. Provide where flashings are in contact with the ground and where indicated.

2.02 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Flashing: As specified in Section 07 65 26.

2.03 MISCELLANEOUS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts and other suitable fasteners designed to withstand design loads and recommended by the manufacturer.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Copper: Copper, hardware bronze, or Series 300 stainless steel.

3. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A153 or ASTM F2329 or Series 300 stainless steel.

4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Copper: ASTM B32, Grade Sn50, 50-percent tin and 50-percent lead.

2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50-percent tin and 50-percent lead or Grade Sn60, 60-percent tin and 40-percent lead.

3. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100-percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanent elastic, non-sag, non-toxic, non-staining tape 1/2-inch wide and 1/8-inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane, polysulfide or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Cheney Flashing Company, Fry Reglet Corporation, Hohmann & Barnard, Inc., Keystone Flashing Company, Inc. or approved equal. Form to provide secure interlocking of separate reglet and counterflashing pieces, compatible with flashing material. Provide factory-mitered and -welded corners and junctions and interlocking counterflashing on exterior face of same metal as reglet.

1. Material: 0.022-inch galvanized steel.

2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers and with channel for sealant at top edge.

3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

4. Provide counterflashing wind-resistant clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.05 FABRICATION, GENERAL

A. General: Custom-fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness and other characteristics. Fabricate items at the shop to the greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight required to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

5. Weld corner transitions watertight.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4-inch in 20-feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or form compatible, non-corrosive metal. Fabricate of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

F. Seams: Fabricate non-moving seams with flat-lock seams. Form seams and seal with elastomeric sealant. Rivet joints where required for strength.

2.06 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors. Downspout profile and hanger style as indicated or as selected by the Architect. Fabricate from the following material:

Material	Thickness
Copper	16-oz./sq. ft.

2.07 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb and similar flashings to extend 4-inches beyond wall openings. Form head and sill flashing with 2-inch-high end dams. Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.022"

2.08 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.028"

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions with installer present, to verify actual locations, dimensions and other conditions affecting performance of the work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare a written report, endorsed by installer, listing conditions detrimental to performance of the work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Flashing Underlayment: Install as specified in Section 07 65 26.

3.03 INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required to complete sheet metal flashing and trim.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12-inches apart. Anchor each cleat with two fasteners, Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated and required for a watertight installation.

6. Torch cutting of sheet metal flashing and trim is not permitted.

7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10-feet with no joints allowed within 24-inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with sealant concealed within joints.

D. Seal joints as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1-inch into sealant. Form joints to completely conceal sealant. When the ambient temperature at time of installation is moderate, between 40- and 70-deg. F., set joint members for 50-percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40-deg. F.

2. Prepare joints and apply sealants to comply with requirements specified in Section 07 92 00.

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2-inches, except reduce pre-tinning where pre-tinned surface would show in completed work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Remove flux and spatter from exposed surfaces.

3.04 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce a complete roof drainage system according to SMACNA recommendations. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.05 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4-inches over base flashing. Install stainless steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4-inches over base flashing. Lap counterflashing joints a minimum of 4-inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

D. Roof Penetration Flashing: Coordinate installation of roof penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof. Coordinate with the work of Section 07 54 23.

3.06 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations. Coordinate installation of wall flashing with installation of wall opening components including windows, doors, and louvers.

3.07 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.08 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4-inch in 20-feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.09 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, remove unused materials and clean finished surfaces. Maintain a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 65 26

SELF-ADHERING SHEET FLASHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing self-adhering sheet flashing material under metal flashings and where indicated.

B. Related Sections:

1. Sheet metal flashing and trim is specified in Section 07 62 00.

2. Joint sealants are specified in Section 07 92 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Furnish manufacturer's standard product data sheets and installation recommendations and instructions. Include written instructions for evaluating, preparing, and treating substrates as well as technical data including tested physical and performance properties.

C. Installer qualifications.

1.03 QUALITY ASSURANCE

A. Installer: Certified or approved by the self-adhering sheet flashing manufacturer to install the specified products with a minimum of 5-years' continuous experience installing the specified materials.

1.04 JOB CONDITIONS

A. Apply self-adhering sheet flashings in fair weather at temperatures of 40-degrees F. and above.

B. Provide adequate ventilation of enclosed spaces where primer is used.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Store materials in their original, sealed packages, labeled with manufacturer's name, product brand name and type, date of manufacture, lot number, and directions for storing.

C. Store materials in a clean, dry and protected location and within temperature range required by the manufacturer. Protect stored materials from direct sunlight.

D. Remove and replace materials that cannot be applied within stated shelf life.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. GCP Applied Technologies “Ultra”, Henry / Fortifiber “FortiFlash Butyl” or approved equal.

2.02 MATERIALS

A. Self-Adhering High-Temperature Sheet Flashing: Underlayment composed of two waterproofing materials – 100-percent butyl rubber adhesive backed by a layer of high density cross laminated polyethylene film.

1. Thickness: 30-mil.

2. Tensile Strength, ASTM D412 (Die C Modified): 250-psi.

3. Elongation, ASTM D412 (Die C Modified): 250-percent.

4. Low Temperature Flexibility, ASTM D1970: Unaffected @ -20-deg. F.

5. Adhesion to Plywood, ASTM D903: 3.0-lbs./in. width.

6. Permeance, ASTM E96: 0.005 perms.

7. Adhesive: 100-percent butyl, contains no asphalt.

B. Primer: As recommended by membrane manufacturer for priming substrates to receive self-adhering sheet flashing.

C. Joint Sealant: Certified by self-adhering flashing manufacturer as being compatible with flashing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which self-adhering sheet flashing will be applied with installer and manufacturer’s representative present for compliance with requirements and for other conditions affecting performance of the self-adhering sheet flashing system. Do not proceed with installation until unsatisfactory conditions have been corrected and reviewed by the Architect.

B. Installation of self-adhering sheet flashing constitutes acceptance of substrate conditions.

3.02 PREPARATION

A. Remove dust, dirt, loose fasteners, and other protrusions. Clean, prepare and treat substrates according to manufacturer’s written instructions. Provide clean, sound, and dry substrate.

B. Prime substrates to receive self-adhering sheet flashing if required by manufacturer. Allow primer to dry for one hour or until tack-free. Re-prime surfaces not covered within 36-hours.

3.03 INSTALLATION

A. Self-Adhering Sheet Flashing:

1. Install self-adhering sheet flashing in accordance with manufacturer’s written instructions. Ensure that flashing adheres continuously with the substrate and is free of wrinkles, fish mouths, bubbles, creases, and other irregularities.

2. Comply with temperature restrictions of underlayment manufacturer for installation. Use primer rather than nails for installing at low temperatures.

3. Apply in shingle fashion to shed water, with end laps of not less than 6-inches staggered 24-inches between courses.

4. Overlap side edges not less than 3-1/2-inches.

5. Carefully notch and fold flashing corners and returns.

6. Roll installed flashing with roller.

7. Installed membrane shall be covered as soon as possible with subsequently applied covering material. Do not leave membrane exposed to the weather for longer periods than approved by the manufacturer.

3.04 COMPLETION

A. Remove and replace self-adhering sheet flashing that does not comply with specified requirements. Holes in the flashing shall be patched with a minimum 6-inch overlap or in accordance with the self-adhering sheet flashing manufacturer's instructions.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

2. Plumbing is specified in Division 22.

3. Electrical is specified in Division 26.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems capable of closing or filling through-penetrations created by the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or by the deflection of sheet metal due to thermal expansion.

B. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

C. For firestopping exposed to view, provide products when flame-spread values of less than 25 and smoke-developed values of less than 450, when tested in accordance with ASTM E84.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's descriptive, technical data and illustrations. Include manufacturer's installation instructions.

C. Certification:

1. Manufacturer's certification that products comply with local regulations controlling use of volatile organic compounds (VOC's) and are nontoxic to building occupants.

2. Manufacturer's certification that firestopping materials comply with ASTM E814 and UL 1479.

D. UL Design Numbers: Furnish UL Design No. from the "Fire Resistance Directory - Volume II" for each required penetration type and configuration. Indicate which materials will be used in firestopping the penetration. Reference architectural, mechanical, plumbing, and electrical drawings.

E. Furnish documentation indicating deflection and elongation capacity of all head of wall assemblies are equivalent in capacity to design assemblies.

1.04 QUALITY ASSURANCE

A. Firestopping materials and systems shall be listed and labeled in accordance with requirements of Underwriters Laboratories, Inc. (UL) Building Materials Directory.

B. Firestopping materials shall conform to IBC for fire resistance standards and requirements for penetrations in walls, partitions, and floor/ceiling and floor/roof assemblies.

C. Firestopping materials shall comply with ASTM E814 and UL 1479.

D. Form materials to remain in place in the completed work and sealant used for firestopping work shall be UL listed and labeled.

E. Firestopping materials shall be rated as required when tested in accordance with ASTM E119.

F. Firestopping materials shall be asbestos free and shall not incorporate nor require the use of hazardous solvents.

G. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surface.

H. Installer shall have a minimum of 5 years' experience installing UL listed firestop systems in similar type construction.

1.05 JOB CONDITIONS

A. Follow manufacturer's instructions for temperature, ventilation, and other conditions for mixing and installing foam seals.

B. Observe and follow manufacturer's precautions when using materials considered toxic and hazardous.

C. Maintain current copy of UL "Fire Resistance Directory" on Project site.

D. Installation of firestopping shall precede finishing of gypsum board.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in the manufacturer's unopened containers and packages with manufacturer's name, labels, product identification, lot numbers, and mixing and installation instructions, as applicable.

C. Store materials in unopened containers and packages, and under conditions recommended by manufacturer.

D. Store and handle firestopping materials in accordance with manufacturer's Material Safety Data Sheets.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping in accordance with manufacturers' instructions by natural means or forced air circulation.

1.08 SEQUENCING AND SCHEDULING

A. Perform work of this and other Sections in proper sequence to prevent damage to the firestopping materials and to ensure that their installation will occur prior to enclosing or concealing work.

B. Do not cover firestopping materials until they have been properly inspected and accepted by the authority having jurisdiction.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the penetrating items.

B. Accessories: Provide components of each firestopping system required to install fill materials. Use only components specified by firestopping manufacturer and which are approved by UL for the designated fire-resistance-rated system.

C. Manufacturers or systems not listed in UL "Fire Resistance Directory" but who can furnish certification of UL approval may be used in the work.

2.02 THROUGH-PENETRATION FIRESTOPPING MATERIALS

A. General: Listed manufacturers of through-penetration firestopping are intended as guidelines only; manufacturer and material type shall be as required by the UL Design No. for each penetration to receive firestopping.

B. Approved Manufacturers: Hilti Construction Chemicals, Inc., STI Firestop, CWS Industrials / RectorSeal, Tremco, Inc., 3M Fire Protection Products or approved equal.

C. Provide mortar, sealants and caulk, putty, wrap strips, pillows, bags, and other types required for UL Design No. for each penetration to receive firestopping.

2.03 MINERAL FIBER FIRESTOPPING MATERIALS

A. Material: Semi-rigid mineral fiber insulation, minimum 4-pcf density; Owens Corning "Thermafiber Safing", Johns Manville "Insul-SHIELD", Tremco “TREMstop FS Blanket” or approved equal.

B. Support Clips: Manufacturer's standard impaling clips or custom designed to suit installation conditions, fabricated from galvanized sheet steel.

2.04 FIRESTOPPING AT ELECTRICAL BOXES AND UTILITY OUTLETS

A. Utility penetrations in walls, ceilings, or floors requiring protected openings shall be firestopped and sealed with an approved material securely installed, capable of maintaining its integrity when subjected to test temperatures specified in ASTM E814.

B. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by a horizontal distance of 24-inches.

C. Steel electrical outlet boxes which occur in combination with outlet boxes of any size such that the aggregate area of unprotected outlet boxes exceeds 100-square inches in any 100-square feet of wall area shall be protected by an approved material or detail to decrease the aggregate area of unprotected utility boxes to less than 100-square inches in any 100-square feet of wall.

D. Steel electrical outlet boxes which exceed 16-square inches in area shall be protected by 3M "Moldable Putty Pads", STI Firestop "SpecSeal SSP Putty & Putty Pads" or approved equal.

E. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall or ceiling assembly. The opening in the gypsum board shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8-inch.

1. Fill the 1/8-inch gap with an approved fire-rated sealant.

2.05 MIXING

A. For those products requiring mixing prior to application, comply with manufacturer's instructions.

2.06 ESCUTCHEONS

A. Provide brushed stainless steel escutcheon plates at pipes and conduit exposed to view. Size to suit penetration.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect openings and voids to be sealed to determine if conditions are satisfactory for the proper installation of firestopping. Do not commence work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.

1. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by manufacturer using manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of the work. Remove tape as soon as possible.

3.03 EXTENT OF FIRESTOPPING WORK

A. General: Provide solid continuous firestopping wherever the penetration or addition of a construction element through or adjacent to a fire-rated floor, wall or partition, or roof creates a discontinuity of such a rated separation. Application limited in size and configuration to tested systems. Do not install insulation types specified in other Sections in lieu of specified firestopping materials.

B. Penetrations:

1. Penetrations include conduit, cable, wire, pipe, duct, and other elements which pass through one or both outer surfaces of a fire-rated floor, roof, wall, or partition.

2. Verify that annular space around sprinkler pipes through fire-rated walls and floors is provided as required by NFPA 13.

C. Fire Rated Partitions:

1. Gaps at smoke rated and fire-rated partitions shall be firestopped with a firestop sealant as listed in UL "Fire Resistance Directory" and as specified. Apply minimum 3/8-inch bead at intersection of finish material and adjacent surface, both sides and along entire perimeter.

2. Intersections at fire-rated partitions and steel deck type floor-ceiling or roof-ceiling assemblies shall be firestopped as required.

D. Provide firestopping to fill miscellaneous voids or openings at fire-rated construction as specified.

3.04 INSTALLATION

A. Do not install firestopping until building is sufficiently enclosed or protected against adverse weather conditions and supporting framing and surrounding construction is in a dry condition.

B. Prepare and install firestopping in accordance with manufacturer's instructions.

C. Mineral Fiber:

1. Provide thickness for compressing into voids for a tight friction fit when installed.

2. Provide a width sufficient to fill the depth of the void space using single width pieces.

3. Install with ends tight against terminal end construction, and with intermediate joints well compressed together and tight.

4. For vertical void spaces, provide support clips near each end, spaced not over 24-inches on center.

D. Foam:

1. Provide form materials to retain foam when placed.

2. Prime contact surfaces as recommended by foam manufacturer.

3. Inject foam into void spaces so foam develops full and complete contact with adjoining surfaces, and the space is free from air pockets.

4. Cure foam 24-hours, remove form materials not required to remain, and inspect.

5. Provide additional foam or sealant to fill insufficient depth and remaining voids.

E. Sealants:

1. Prepare penetrations in vertical and horizontal surfaces as required to receive finished products.

2. Install damming materials as required.

3. Apply caulk or putty in accordance with manufacturer's recommendations.

F. Finish surfaces of exposed to view firestopping to a uniform and level condition.

G. Firestopping shall not extend past edges of cover plates, escutcheons, etc. or where it will be exposed to view in the final assembly.

H. Install escutcheon plates at pipes and conduit exposed to view.

3.05 FIELD QUALITY CONTROL

A. Identify firestop systems after installation. Identify the firestop system that has been installed and include the appropriate UL Design Number.

B. At fire-rated walls, partitions, smoke barriers and other walls required to have protected openings or penetrations, provide a sign or stenciling on each side of the wall above the accessible ceiling stating that penetrations through fire-rated walls and partitions are not permitted unless such penetrations or openings are protected with firestopping meeting code requirements. Letters shall not be less than 1/2-inch in height. Repeat at intervals not exceeding 10-feet measured horizontally. Signs or stenciling shall comply with IBC Chapter 7 requirements.

3.06 CLEANING

A. Remove spilled and excess materials without damaging adjacent surfaces.

B. Leave finished work in neat, clean condition with no evidence of spill-overs or damage to adjacent surfaces.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing joint sealants.

B. Related Sections:

1. Firestopping sealants are specified in Section 07 84 00.

2. Joint sealants related to flashing and sheet metal work are specified in Section 07 62 00.

3. Acoustical joint sealants are specified in Section 07 92 19.

4. Glazing sealants are specified in Section 08 80 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data for each product required, including instructions for joint preparation and sealant application. Include certification by joint sealant manufacturer that sealants, primers, and cleaners comply with local regulations controlling the use of volatile organic compounds (VOC).

C. Samples: Manufacturer's bead samples of actual products showing full range of colors available, for each product exposed to view.

D. Test Reports:

1. Certified test results of elastomeric sealants showing compliance with specified requirements. Include results of aged performances including hardness, stain-resistance, adhesion and cohesion under cyclic movement, low temperature flexibility, modulus of elasticity at 100-percent strain, affects of heat and aging, and affects of accelerated weathering.

2. Pre-construction field test results indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.

E. Certificates: Manufacturer's certification that joint sealants comply with specified requirements and are suitable for uses indicated.

F. Warranty.

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Completion of at least 3 installations similar in type and size to this Project.

B. Obtain joint sealant materials from a single manufacturer for each product required unless otherwise approved.

C. Preconstruction Field Testing: Prior to installation of joint sealants, field-test adhesion to joint substrates.

2. Install joint sealants in 5-foot joint lengths. Allow to cure before testing. Test adhesion by pulling sealant out of joint according to "Method A, Field-Applied Sealant Joint Hand Pull Tab", in Appendix X1 in ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Perform field tests for each type of elastomeric sealant and joint substrate.

4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

5. Report if sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

6. Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrate during testing.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

C. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not install sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or to wet joint substrates.

B. Joint Width Conditions: Do not install sealants when joint widths are less than permitted by sealant manufacturer.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.06 WARRANTY

A. Exterior Sealants: Furnish a written warranty against leaks or other defects of materials and workmanship for a period of 10 years. Defects include but are not limited to changes in the structural, physical or chemical properties of the sealant materials that impair function or require abnormal maintenance, changes in surface finish, color or texture, failure in adhesion, weather resistance or durability, failure to prevent entry of water, or failure to comply with specified requirements.

B. This warranty shall not cover formation of cracks or defects in substrate materials adjacent to the seal, joint movement exceeding movement rating of sealant, or physical damage caused by others.

C. Repair or replace defective materials and workmanship during warranty period without expense to Owner, including removal and replacement of other items as required.

D. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Provide color of exposed joint sealants as selected by Architect. Custom colors will be used.

B. Provide joint sealers, joint fillers and other materials that are compatible with one another and with joint substrates, as demonstrated by testing and field experience.

2.02 ELASTOMERIC JOINT SEALANTS

A. Exterior Paintable Building Sealant: Bostik Findley, Inc. “Pro MS-50”, BASF “Master Seal NP 150 Premium Sealant” or approved equal latex hybrid sealant.

B. Exterior Building Sealant at Exposed Concrete, Stone Veneer, Doors and Windows, and Areas where Sealant is Unpainted: Dowsil “795 Silicone” or approved equal

C. Interior Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920 Type S; Grade NS; Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures; Dowsil "786 Mildew Resistant", GE "Sanitary 1700", Sonneborn Building Product Div. "Sonolastic Omniplus", Tremco Tremsil 200 or approved equal.

D. Horizontal Joint Sealant: Two-part pourable urethane; ASTM C920, Type M; Grade P; Class 25; Uses T, M, A and O; Pecora Corp. "NR-200 Urexpan", Sonneborn "Sonolastic Paving Joint Sealant", Tremco, Inc. "THC-900/901" or approved equal. Horizontal joint sealant shall have a minimum Shore A hardness of 30.

2.03 LATEX JOINT SEALANTS

A. Interior Building Sealant: Acrylic-emulsion; one-part, non-sag, mildew-resistant, complying with ASTM C834, formulated to be paintable; Pecora Corp. "AC-20", Sonneborn "Sonolac", Tremco Inc. "Tremco Acrylic Latex 834" or approved equal.

2.04 JOINT FILLERS FOR CONCRETE PAVING

A. Joint Filler: Preformed cork strips complying with ASTM D1752 for Type II or preformed sponge rubber strips complying with ASTM D1752 for Type I.

2.05 JOINT SEALANT BACKING

A. General: Provide sealant backings which are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved by sealant manufacturer.

B. Backer Rod at Exterior Locations: ASTM C1330, Type C, closed cell backer rods.

C. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam, of size, shape, and density to control sealant depth.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: As recommended by joint sealant manufacturer for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove foreign material from joint substrates which could interfere with adhesion of joint sealant, including dust, paints, oil, grease, waterproofing, water repellents, water, and surface dirt.

2. Clean porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.

3. Remove laitance and form release agents from concrete.

4. Clean non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Provide temporary ventilation during installation of interior joint sealants.

B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint-fillers to provide sealant support for optimum performance cross-sectional shapes and depths.

a. Do not leave gaps between ends of joint-fillers.

b. Do not stretch, twist, puncture, or tear joint-fillers.

c. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.

D. Installation of Sealants: Install sealants by proven techniques to contact and full wet joint substrates, completely filling recesses provided for each joint configuration and providing uniform, optimum performance cross-sectional shapes and depths.

E. Tooling of Non-sag Sealants: Tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.03 PROTECTION AND CLEANING

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage.

B. Cut out and remove damaged or deteriorated joint sealers and reseal joints with matching new materials.

C. Clean off excess sealants or smears adjacent to joints as work progresses by methods and with cleaning materials approved by sealant manufacturer.

END OF SECTION

SECTION 07 92 19

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing acoustical joint sealants.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

2. Acoustic insulation is specified in Section 09 81 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data for each product required, including instructions for joint preparation and sealant application. Include certification by joint sealant manufacturer that sealants, primers, and cleaners comply with local regulations controlling the use of volatile organic compounds (VOC).

C. Samples: Manufacturer's bead samples of actual products showing full range of colors available, for each product exposed to view.

D. Certificates: Manufacturer's certification that joint sealants comply with specified requirements and are suitable for uses indicated.

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Completion of at least 3 installations similar in type and size to this Project.

B. Obtain joint sealant materials from a single manufacturer for each product required unless otherwise approved.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

C. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not install sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or to wet joint substrates.

B. Joint Width Conditions: Do not install sealants when joint widths are less than permitted by sealant manufacturer.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant: Non-drying, non-hardening, permanently flexible, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound; Pecora Corporation "BA-98", Tremco Inc. "Tremco Acoustical Curtainwall Sealant", USG “Sheetrock Brand Acoustical Sealant” or approved equal.

B. Fire-rated Acoustical Sealant: Fire-rated, non-skinning, non-hardening, permanently flexible sealant; Pecora Corporation “AC-20 FTR”, CSW Industrials / Rectorseal “Metacaulk 1000 Intumescent Firestop Sealant” or approved equal.

2.02 MISCELLANEOUS MATERIALS

A. Sheet Caulking for Junction Boxes: Lowry’s Electrical Box Sealer, Tremco sheet caulking or approved equal.

B. Sheet Caulking for Junction at Fire-Rated Assemblies: Nelson Firestop Products “FSP Firestop Putty”, Hilti CP 617, STI Firestop “SpecSeal SSP Firestop Putty” or approved equal.

C. Backing Rod: Closed-cell, neoprene rod or polyethylene foam.

D. Expanding Foam Sealant: UL Class 1 fire-retardant; AkzoNobel “Polycell Expanding Foam”, Dow “Great Stuff Pro – Gaps & Cracks” or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions for installation conditions.

B. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated. Install sealants in accordance with manufacturer’s instructions.

C. Use acoustical sealant to form an airtight seal at all penetrations and perimeter of sound-rated partitions, floors and ceilings and as indicated. Comply with Section 09 29 00. Use backer rod where gaps to be sealed exceed 3/8-inch.

D. Use sheet caulking to seal the back and sides of all junction boxes (4 gang and smaller) recessed in sound-rated partitions.

E. Apply acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound rated partitions and around the perimeter of resilient ceilings.

F. Apply expanding foam sealant where indicated and where multiple pipes or conduits penetrate sound rated construction.

3.02 PROTECTION

A. Protect installed insulation from harmful exposures and from physical damage.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing hollow metal doors, door frames and fixed window frames.

B. Related Sections:

1. Flush wood doors are specified in Section 08 14 16.

2. Stile and rail wood doors are specified in Section 08 14 33.

3. Hot-rolled steel doors are specified in Section 08 13 76.

4. Hot-rolled steel windows are specified in Section 08 51 26.

5. Door hardware is specified in Section 08 71 00.

6. Glazing is specified in Section 08 80 00.

7. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Furnish for each type of door and frame, including details of construction, materials, dimensions, hardware preparation, core, label compliance, profiles, and finishes.

C. Shop Drawings: Include details of each frame type, elevations of door types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items. Reference architectural details, door number and hardware group.

D. Door Schedule: Furnish complete schedule of doors and frames using same reference numbers for details and openings as those on the drawings.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Steel doors and frames shall comply with ANSI A250.8 "Recommended Specifications Standard Steel Doors and Frames" and the specified requirements.

B. Fire-Rated Doors: Provide hollow metal doors and frames that comply with IBC Chapter 7; are identical in materials and construction to units tested in door and frame assemblies in accordance with NFPA 252 or UL 10C; and are labeled and listed by UL, Warnock Hersey, or other testing and inspection agency acceptable to authorities having jurisdiction. Labels shall comply with NFPA 80 and be permanently affixed to the door.

C. Hollow metal doors and frames shall comply with positive pressure test requirements of NFPA 252 or UL 10C and shall be labeled accordingly by the door and frame manufacturer in a manner approved by authorities having jurisdiction. Door label shall include hourly rating followed by the letter "S" indicating conformance with air leakage resistance testing, serial number, and the listing agency's certification mark.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.

C. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided finish items are equal to new work and acceptable to Architect; otherwise remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid use of non-vented plastic or canvas shelters that could create humidity chamber. If the cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch space between stacked doors to promote air circulation.

1.05 WARRANTY

A. Warrant hollow metal doors and frames to be free from defects in materials and workmanship for a period of 2 years from date of Substantial Completion. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Assa Abloy / Ceco Door Products, Assa Abloy / Curries Company, Assa Abloy / Security Metal Products, Republic Doors and Frames, Allegion / Steelcraft or approved equal. The manufacturer shall be a SDI Certified Manufacturer.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A569.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A366, commercial quality or ASTM A620, drawing quality.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A526, commercial quality, or ASTM A642, drawing quality, hot dipped galvanized in accordance with ASTM A653, A60 or G90 coating designation, mill phosphatized.

D. Supports and Anchors: Fabricate of not less than 16-gauge, galvanized where used with galvanized frames.

E. Inserts, Bolts and Fasteners: Manufacturer's standard units. Where items are built into exterior walls, hot dip galvanize in accordance with ASTM A153, Class C or D as applicable.

F. Shop Applied Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for finish paint coats specified in Section 09 91 00.

2.03 DOORS

A. Provide metal doors of ANSI A250.8 grades and models specified.

1. Interior Flush Doors: Level 2, heavy duty, Model 2 minimum 18-gauge cold-rolled sheet steel faces.

2. Interior Stile and Rail Doors: Level 3, extra heavy duty, Model 3, minimum 16-gauge cold-rolled sheet steel faces.

3. Exterior Flush Doors: Level 3, extra heavy duty, Model 2, minimum 16-gauge galvanized steel faces.

4. Exterior Stile and Rail Doors: Level 3, extra heavy duty, Model 3, minimum 16-gauge galvanized steel faces.

B. Door Louvers: Sight-proof stationary louvers, constructed of inverted V-shaped or Y-shaped blades formed of 24-gauge cold-rolled steel set into minimum 20-gauge steel frame. Provide galvanized louvers and frames in exterior doors.

C. Internal Construction: Unitized steel grid or vertical steel stiffeners with internal sound deadener on inside of face sheets, in accordance with ANSI A250.8 requirements. Exterior doors shall have a polyurethane or polystyrene insulated core.

D. Clearance: Not more than 1/8-inch at jambs and heads. Not more than 3/8-inch at bottom. Threshold clearances as indicated.

1. Fire Doors: Provide clearances according to their listing except where more stringent requirements are specified.

E. Edges:

1. General: Beveled latch stile for single doors, and meeting stile for pair doors; square elsewhere.

2. Stile Edges: No seams are allowed on vertical stile edges.

3. Top and Bottom Edges: Reinforced with 16-gauge steel channels; both edges flush and made watertight for exterior doors, top edge flush for interior doors.

F. Glazing: Provide minimum 20-gauge steel non-removable glazing stops on the outside of exterior doors and on the secure side of interior doors. Glazing beads on the inside of glass panels shall be removable.

2.04 DOOR AND INTERIOR FIXED WINDOW FRAMES

A. One-Piece Welded Frames: 16-gauge. Fabricate frames with mitered or coped and continuously welded corners. Provide at exterior locations.

B. Knock-Down Frames: 16-gauge. Fabricate frames with mitered corners knocked down for field assembly. Provide at interior locations.

C. Glazing Beads: Provide frame glazing beads in interior glazed openings and other locations where fixed glass is indicated. Prepare frames for the type of glazing beads required to receive the glass and gaskets indicated. Miter or butt join beads at corners. Glazing beads shall be screw-on type to receive countersunk flat head machine screws.

D. Anchors:

1. Provide a jamb anchor for each 2'-6" of door or window height or fraction thereof.

2. Fabricate from minimum 16-gauge sheet steel.

3. Vary anchor types to provide positive fastening to adjacent construction. Provide corrugated galvanized steel strap anchors for anchorage into masonry walls.

4. Secure a metal clip angle at bottom of each jamb member for anchoring to floor, with a minimum of two fasteners.

5. Items to be built into exterior walls shall be hot-dip galvanized after fabrication in accordance with ASTM A153, Class B.

E. Door Silencers: Except on weatherstripped or smoke gasketed frames, drill stops to receive 3-silencers on strike jambs of single-swing frames and 2-silencers in heads of double-swing frames.

F. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes at back of hardware cutouts.

2.05 FABRICATION

A. Fabricate steel doors and frames to be rigid, neat in appearance and free from defects, warp, or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project site. Comply with ANSI A250.8 requirements.

B. Fabricate exposed faces of doors, including stiles and rails of non-flush units, from cold-rolled steel.

C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel.

D. Fabricate exterior doors and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gauge inverted steel channels with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.

E. Tolerances: Comply with SDI-117, "Manufacturing Tolerances Standard Steel Doors and Frames" unless otherwise indicated or specified.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat heads for exposed screws and bolts.

G. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6 for door frame preparation for hardware.

H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping of surface-applied hardware may be done at Project site.

I. Locate hardware as indicated on final shop drawings and in accordance with Door Hardware Institute (DHI) "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames".

J. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces and both faces and all 4 edges of doors.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive paint finish specified in Section 09 91 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install steel doors, frames, and accessories in accordance with the manufacturer's instructions, the requirements of ANSI/SDI, and final reviewed Shop Drawings.

B. Placing Frames: Comply with provisions of ANSI A250.8 and SDI-112 unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.

1. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.

2. In stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. Attach wall anchors to studs with screws.

3. Install fire-rated frames according to their listings.

4. Install head anchors at mid span for openings exceeding 48-inches.

C. Door Installation: Fit hollow metal doors accurately in frames, within specified clearances.

1. Fire-Rated Doors: Install with clearances specified in their listings and as specified.

3.02 ADJUST AND CLEAN

A. Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

1. Remove rust before touch-up is applied.

2. Touch-up shall not be obvious.

B. Repair damaged galvanizing with galvanizing repair paint.

C. When complete, exposed surfaces and edges shall be clean, straight, and free from dents, scratches, and other damage and defects.

D. Doors and finish hardware shall operate smoothly, quietly, and free from bind.

END OF SECTION

SECTION 08 13 76

HOT-ROLLED STEEL DOORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:

1. Steel thermally broken outswing hot-rolled steel doors.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

2. Hot-rolled steel windows are specified in Section 08 51 26.

3. Glazing is specified in Section 08 80 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Shop Drawings: Show door and installation details, including anchorage, fastening and sealing methods. Include dimensioned elevations showing door opening and door sizes.

C. Samples: Minimum 6-inch-long door sections with applied finish.

D. Warranty.

1.03 PERFORMANCE REQUIREMENTS

A. Air Infiltration: Not more than 0.3-cfm/sq. ft. of overall frame area at an inward test pressure of 6.24-psf.

B. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 6.0-psf.

C. Structural Performance: No glass breakage, damage to hardware, or permanent deformation that would impair unit operation or cause residual deflection greater than 0.4-percent of the span at a positive (inward) and negative (outward) test pressure of 30-lbf per sq. ft.

1.04 QUALITY ASSURANCE

A. Allowable Tolerances: Size dimensions +/- 1/16 inch.

1.05 WARRANTY

A. Warrant steel door finish to be free from corrosion for a period of 10-years from date of Substantial Completion.

B. Warrant steel doors to be free from defects in materials and workmanship, including but not limited to structural defects, for a period of 10 years from date of Substantial Completion.

C. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Thermally broken steel weatherstripped doors shall be manufactured from steel shapes with glass-fiber-reinforced or polyamide and high-density polyurethane thermal break.

1. Perimeter frames and door leaf sections shall have glazing rebates providing an unobstructed glazing surface 3/4-inch in height. Muntin glazing rebates shall provide an unobstructed glazing surface 3/4-inch in height for 1-inch-thick glazing.

2. The door leaf sections shall have an integral dovetail groove located on both bedding contacts for the reception of weatherstripping.

3. Doors shall be NFRC certified with temporary and permanent labels.

4. Comply with AAMA101 or ASTM E330.

B. Glazing Beads: Manufacturer's standard.

C. Glazing Sealant: Dowsil "795" or approved equal structural silicone glazing sealant.

D. Weatherstripping: Extruded vinyl.

2.02 FINISH

A. Hot-dip galvanized finish followed by zinc phosphate pre-treatment and finish as selected by the Architect.

2.03 GLAZING

A. Doors shall be designed for inside glazing. Provide replaceable continuous snap-in glazing beads to suit the glass as specified. Glass shall be 3/4-inch thick with 1-1/8-inch true divided lite muntins or 1-inch integrated divided lites.

2.04 WEATHERSTRIPPING

A. Apply continuous vinyl weatherstripping to the integral weatherstrip groove in the interior and exterior contact surfaces of the ventilator sections. Apply sill sweep weatherstripping to a retainer to allow for easy replacement.

2.05 DOOR HARDWARE

A. Outswing Door Hardware: Door manufacturer's hinges, locking hardware, and door levers as selected by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install doors in openings in accordance with manufacturer's instructions and approved shop drawings.

B. Set units plumb, level and true to line, without warp or rack of frames.

C. Anchor units securely to surrounding construction with approved fasteners.

D. The exterior joints between the door, saddle, trim and mullions shall be properly sealed watertight with an approved sealant and neatly pointed.

E. Attach field applied hardware and adjust doors to operate smoothly, free from twist, and to be weathertight when closed.

3.02 TOUCH-UP

A. Repair abraded areas of the factory finish.

B. Leave door surfaces clean after installation and ready to receive glass and glazing.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing flush wood doors.

B. Related Sections:

1. Interior architectural woodwork is specified in Section 06 40 23.

2. Hollow metal doors and frames are specified in Section 08 11 13.

3. Stile and rail wood doors are specified in Section 08 14 33.

4. Door hardware is specified in Section 08 71 00.

5. Glass for vision panels is specified in Section 08 80 00.

6. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's descriptive and technical data and illustrations for each type of door including details of core and edge construction, and trim for openings.

C. Shop Drawings: Indicate location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other data.

1. Shop drawings shall comply with North American Architectural Woodwork Standards (NAAWS 4.0) Section 01 – Submittals.

2. Furnish a Woodwork Institute “Certified Compliance Label” on the first page of the shop drawings.

D. Samples:

1. Submit 24-inch square or larger samples as specified or required to represent required characteristics. Resubmit samples until approved.

a. Doors for Transparent Finish: Door faces with solid wood edging representing typical range of color and grain for each species of veneer. Samples shall be representative of the complete range of wood veneer colors to be expected in the work.

2. Furnish full-size door for transparent finish showing the complete range of color and grain to be expected in the completed work. Resubmit until sample is approved by the Architect. The approved sample will be used to judge the acceptability of transparent finished door veneer and may be used in the Project.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Flush wood door construction shall comply with NAAWS 4.0 Section 09 for Premium grade doors.

B. Fire-Rated Doors: Provide wood doors that comply with IBC Chapter 7; are identical in materials and construction to units tested in door and frame assemblies in accordance with NFPA 252 or UL 10C; and are labeled and listed by UL, Warnock Hersey, or other testing and inspection agency acceptable to authorities having jurisdiction. Labels shall comply with NFPA 80 and be permanently affixed to the door.

C. Allowable Tolerances:

1. Warp Tolerance: As specified in Section WDMA T-2. In addition, warp tolerance shall apply to pairs of doors and to doors in relation to the frame or jamb in which hung.

2. Squareness: WDMA T-3.

3. Gap Tolerance: As specified in NAAWS 4.0 Section 15.

4. Flushness of Joinery: As specified in NAAWS 4.0 Section 15.

D. Flush wood doors and steel frames specified in Section 08 11 13 shall comply with positive pressure test requirements of NFPA 252 or UL 10C and shall be labeled accordingly by the door and frame manufacturer in a manner approved by authorities having jurisdiction. Door label shall include hourly rating followed by the letter “S” indicating conformance with air leakage resistance testing, serial number, and the listing agency’s certification mark.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver doors individually protected with polyvinyl or plastic wrap, identified with manufacturer's name, and name and type of door. Identify each door with the same symbol used on door schedule. Leave protection on door during construction.

1. Comply with NAAWS 4.0 Section 02 for delivery, storage, and handling of doors.

C. Store doors covered and flat, supported above a level surface in a dry, well-ventilated building in compliance with NAAWS 4.0 Section 02.

D. Do not subject doors to extremely high or low temperatures or humidity.

E. Handle with clean gloves; do not drag doors across one another or other surfaces.

F. Certain wood species are light sensitive. Protect doors from exposure to natural and artificial light after delivery.

1.05 PROJECT CONDITIONS

A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of construction period in compliance with the requirements specified in NAAWS 4.0 Section 02.

1.06 WARRANTY

A. Warrant each solid core interior door against defects in materials and workmanship for the life of the original installation, including costs of re-hanging. Defects include, but are not limited to the following:

1. Cores shall not telegraph through door faces. Stile, rail, and core show-through shall be considered a defect when the face of the door varies from a true plane exceeding 0.010-inch in a 3-inch span.

2. Doors shall not have warped (bow, cup, or twist) more than that permitted in NAAWS 4.0 Section 15.

B. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Masonite Architectural “Aspiro Series | Marshfield-Algoma”, VT Industries, Oregon Door or approved equal.

2.02 FLUSH WOOD DOORS, GENERAL

A. Type: Flush veneered, five-ply construction. Doors with seven-ply construction will not be acceptable.

B. Flush Wood Door Minimum ANSI/WDMA I.S. 1A Performance Requirements:

1. Solid Core Doors: Extra Heavy-Duty performance level.

2. Hollow Core Doors: Standard Duty performance level.

C. Door Grade:

1. Fabricate flush wood doors to receive transparent finish in accordance with NAAWS 4.0 Premium Grade.

2. Fabricate flush wood doors to receive opaque finish in accordance with NAAWS 4.0, Custom Grade.

D. Cross Banding: Manufacturer's standard, minimum 1/16-inch thick. Fire-retardant treated where required by testing agency.

E. Fabricate wood doors in sizes indicated for either job-site fitting or factory fit doors to suit frame-opening sizes indicated, at the Contractor's option. Doors shall comply with the following uniform clearances and bevels:

1. Non-rated Doors:

a. Jambs and Heads: 1/8-inch.

b. Meeting Stiles of Pairs of Doors: 1/8-inch.

c. Bottom of Door to Top of Finish Floor: 1/2-inch at concrete and resilient flooring, 3/8-inch at carpet, tile, threshold, and other finish flooring.

2. Fire-rated Doors: Comply with requirements of IBC Chapter 7 and NFPA 80.

G. For doors that are pre-machined, factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

H. Factory Finishing:

1. Doors to be Field Painted: Prime paint doors suitable for field painting as specified in Section 09 91 00. Seal cut-outs, edges, and other surfaces not otherwise finished.

2. Transparent Finish Doors: Prefinished to match Architect approved samples as follows:

a. Standard: NAAWS 4.0 – Section 05.

b. NAAWS 4.0 Grade: Premium.

c. NAAWS 4.0 Finish System: Section 05 – System 11, Catalyzed Polyurethane.

d. Wash Coat: Reduced vinyl sealer at stained finish.

e. Stain: Match approved sample for color.

f. Sealer: Vinyl.

g. Finish: Two topcoats in sheen to match approved sample.

2.03 INTERIOR FLUSH WOOD DOORS

A. Veneer:

1. Transparent Finish Doors

a. Veneer Species and Grade: NAAWS 4.0 Grade AA, species and cut to be selected by the Architect or Interior Designer.

b. Veneer Matching: Book and center balance matching.

c. Pairs and Sets: Provide pair matching and set matching for pairs of doors and for doors hung in adjacent sets.

d. Doors in the same room or area shall be matched for color and grain.

2. Painted Doors:

a. Veneer Species and Grade: NAAWS 4.0 Grade A, Birch or other close grain hardwood. MDO faced doors may be used at Contractor's option.

B. Adhesive: WDMA IS-1.6, Type II adhesive bond or better for cores, Type I adhesive bond for faces and cross bands.

C. Cores:

1. 20-Minute Fire-Rated Doors and Non-rated Doors (PC-5): Solid particleboard conforming to ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.

2. Fire-Rated Doors Greater than 20-Minute Rated (FD-5): Incombustible mineral approved by labeling authority. Provide top, bottom, and intermediate blocking for surface-mounted hardware.

D. Edge Construction:

1. 20-Minute Fire-Rated Doors and Non-rated Doors:

a. Stiles and Rails: Minimum 1-3/8-inch wide by full core thickness glued to core. Provide wider hinge stile where recommended by door manufacturer for door size and type of hinges to be used. Exposed edges of stiles shall be smooth, straight cut, free from knots, pitch pockets, and other defects for a minimum distance of 1/4-inch from the outside edge along the entire stile.

b. Species:

1) Stiles:

a) Same species as face for doors to receive transparent finish with no finger joints permitted on lock stiles.

b) Close-grain hardwood for doors to receive paint finish.

2) Rails: Hardwood or softwood at manufacturer's option.

c. Edge Banding: Minimum 1/2-inch wide by full core thickness. Edge bands if used may reduce the width of stiles and rails.

1) Species for doors to receive transparent finish shall be same as face with no finger joints permitted on lock stile.

2) Species for doors to receive paint finish shall be close-grain hardwood.

2. Fire-Rated Doors Greater than 20-Minute Rated:

a. Top Rail: Door manufacturer’s standard special laminated material.

b. Stiles and Rails: Hardwood, fire-retardant treated where required by label. Where not required to be fire-retardant treated, provide same species for stiles as face veneer for doors to receive transparent finish. Sizes required by testing agency.

3. Bevel non-rated doors 1/8-inch in 2-inches at lock and hinge edges.

4. Bevel fire-rated doors 1/8-inch in 2-inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

2.04 LIGHT FRAMES

A. Factory-installed prefabricated steel units, factory-primed for field painting.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine door frames and verify that frames are of the correct type and have been installed as required for proper hanging of corresponding doors. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

3.03 INSTALLATION

A. Install wood doors in accordance with the manufacturer's printed instructions, as indicated and in accordance with NAAWS 4.0, Section 14.

B. Factory-finished doors shall be installed just prior to Substantial Completion.

C. Fire-Rated Doors: Install in fire-rated frames in accordance with requirements of NFPA Standard No. 80.

D. Job-Fit Doors: For doors not factory-machined, align and fit doors in frames with uniform clearances and bevels as specified; do not trim stiles and rails exceeding limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Fitting Clearances:

a. Non-rated Doors:

1) Jambs and Heads: 1/8-inch.

2) Meeting Stiles of Pairs of Doors: 1/8-inch.

3) Bottom of Door to Top of Finish Floor: 1/2-inch at concrete and resilient flooring, 3/8-inch at carpet, tile, thresholds and other finish flooring.

b. Fire-rated Doors: As specified in IBC Chapter 7 and NFPA 80.

2. Bevel non-rated doors 1/8-inch in 2-inches at lock and hinge edges.

3. Bevel fire-rated doors 1/8-inch in 2-inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Cutouts, Recesses, and Exposed Rail Edges: Unless factory provided, paint with two coats of clear sealer, each coat well dried, before hardware is set in place.

G. Meeting stiles of pairs of doors shall be in alignment along the entire height and offset between adjacent leaves shall not exceed 1/8-inch.

3.04 ADJUSTING AND PROTECTION

A. When complete, doors shall be flat within allowable tolerance, shall be plumb in all positions of swing, and shall operate smoothly, quietly, and free from binding. Re-hang or replace doors that do not swing or operate freely.

B. Exposed surfaces shall be uniform in appearance, clean and free from scratches, tool marks, dents, discoloration, stains, and other damage and defects.

C. Refinish or replace doors damaged during installation.

D. Protect doors as recommended by door manufacturer to ensure that doors will be without damage or deterioration at completion of Project.

END OF SECTION

SECTION 08 14 33

STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following types of stile and rail wood door as scheduled:

1. Interior stile and rail wood doors with wood panels.

2. Interior stile and rail wood doors with glass panels.

3. Interior fire-rated stile and rail wood doors.

4. Exterior stile and rail wood doors with glass panels.

B. Related Sections:

1. Interior architectural woodwork is specified in Section 06 40 23.

2. Hollow metal doors and frames are specified in Section 08 11 13.

3. Flush wood doors are specified in Section 08 14 13.

4. Door hardware is specified in Section 08 71 00.

5. Glazing is specified in Section 08 80 00.

6. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Door manufacturer's technical data for each type of door, including details of construction, materials, dimensions of individual components, profiles, and finishes.

C. Shop Drawings: Indicate location and size of each door; elevation of each door; construction details not covered in product data including stiles, rails, panels, and moldings; location and extent of hardware cutouts; and factory finishing requirements.

1. Shop drawings shall comply with North American Architectural Woodwork Standards (NAAWS) 4.0 Section 01 – Submittals.

2. Apply a Woodwork Institute “Certified Compliance Label” on the first page of the shop drawings.

D. Samples: Corner section, 1'-0" square, showing edges, faces, joinery and material qualities of typical stile, rail, molding and panel for each exposed material, door type and finish required.

1. Doors for Transparent Finish: Door faces representing typical range of color and grain for each veneer and lumber species.

2. Factory-Finished Doors: Finished door faces representing typical factory finish.

E. Certificate of Compliance: Manufacturer's certificate showing compliance with specified requirements.

F. Warranty.

1.03 QUALITY ASSURANCE

A. Interior stile and rail wood door construction shall comply with NAAWS 4.0 Section 09 for Premium grade doors.

B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies in accordance with ASTM E152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Fire-rated stile-and-rail wood doors and steel frames specified in Section 08 11 13 shall comply with positive pressure test requirements of NFPA 252 / UL 10C and shall be labeled accordingly by the door manufacturer in a manner approved by authorities having jurisdiction. Door label shall include hourly rating followed by the letter “S” indicating conformance with air leakage resistance testing, serial number, and the listing agency’s certification mark.

D. Safety Glass: Provide products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

E. Product Certification: Require door manufacturer to certify that doors comply with specified requirements including those of referenced door standard. Mark, label or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6.

F. Allowable Tolerances:

1. Warp Tolerance: As specified in Section WDMA T-2. In addition, warp tolerance shall apply to pairs of doors and to doors in relation to the frame or jamb in which hung.

2. Squareness: WDMA T-3.

3. Gap Tolerance: As specified in NAAWS 4.0 Section 15.

4. Flushness of Joinery: As specified in NAAWS 4.0 Section 15.

G. Manufacturer: Firm with not less than 5 years of production experience like this Project, whose qualifications indicate the ability to comply with the specified requirements. The manufacturer shall have at least one project in the past 5-years where the value of the wood doors was within 20-percent of the cost of the wood doors for this Project.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration.

1. Comply with NAAWS 4.0 – Section 02 for delivery, storage, and handling of doors.

C. Store doors covered and flat, supported above a level surface in a dry, well-ventilated building in compliance with NAAWS 4.0 – Section 02.

D. Identify each door with opening numbers corresponding with shop drawing designations for doors, frames, and hardware, using temporary, removable, or concealed markings.

1.06 PROJECT CONDITIONS

A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with NAAWS 4.0 Section 02 requirements applicable to Project's geographical location.

1.07 WARRANTY

A. Warrant interior stile and rail wood doors against defects in materials and workmanship for the life of the Installation, including cost of removing and re-hanging.

B. Warrant interior fire-rated stile and rail wood doors with glass panels against defects in materials and workmanship for a period of 1-year from date of Substantial Completion, including cost of removing and re-hanging.

C. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 INTERIOR NON-RATED AND 20-MINUTE RATED STILE AND RAIL WOOD DOORS

A. Approved Manufacturer: Masonite Architectural “Aspiro Series | Harring” or approved equal.

B. Door Grade: NAAWS 4.0 – Section 09, Premium Grade.

C. Panel Design: As indicated.

D. Wood Species and Cut:

1. Doors for Transparent Finish: NAAWS 4.0 Section 04, Grade AA, species and cut to be selected by the Architect, minimum 1/16-inch-thick veneer. Doors in the same room or area shall be matched for color and grain.

2. Doors for Opaque Finish: NAAWS 4.0 Section 04, Grade A, Fir or Pine.

E. Joinery: Cope and stick, doweled.

F. Stile, Rail and Mullion Dimensions:

1. Widths: As indicated or as standard with door manufacturer.

2. Construction: SCLC.

G. Stile, Rail and Mullion Construction:

1. Transparent Finish Doors: Veneered core.

2. Opaque Finish Doors: Two-piece balanced lamination with opposing grain.

H. Raised Wood Panels:

1. Panel Construction: Raised, 2-ply solid lumber or 3-ply solid lumber.

2. Sticking: As indicated or as selected by the Architect.

3. Panel Thickness: Minimum 1-1/8-inch.

I Glass or Flat Wood Panels:

1. Sticking: As indicated or as selected by the Architect.

2. Glass: As indicated and as specified in Section 08 80 00.

3. Flat Wood Panels: 5/8-inch thick, any of the following:

a. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2, faced with MDO.

b. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, faced with MDO.

c. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade 130, faced with MDO.

d. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin

J. Doors shall be glued-up with Type I or Type II adhesive, at manufacturer's option.

K. Factory Finishing:

1. Doors to be Field Painted: Prime paint doors suitable for field painting as specified in Section 09 91 00. Seal cut-outs, edges, and other surfaces not otherwise finished.

2. Transparent Finish Doors: Prefinish to match Architect approved samples as follows:

a. Standard: NAAWS 4.0 Section 05.

b. NAAWS 4.0 Grade: Premium.

c. NAAWS 4.0 Finish System: Section 05 – System 11, Catalyzed Polyurethane.

d. Wash Coat: Reduced vinyl sealer at stained finish.

e. Stain: Match approved sample for color.

f. Sealer: Vinyl.

g. Finish: Two topcoats in sheen to match approved sample.

2.02 INTERIOR 45-90 MINUTE FIRE-RATED STILE AND RAIL WOOD DOORS

A. Approved Manufacturer: Masonite Architectural “Aspiro Series | Haring” 45 – 90 Min Fire Rated or approved equal.

B. Door Grade: NAAWS 4.0 – Section 09, Premium Grade.

C. Panel Design: As indicated.

D. Wood Species and Cut:

1. Doors for Transparent Finish: NAAWS 4.0 Section 04, Grade AA, species and cut to be selected by the Architect, minimum 1/16-inch-thick veneer. Doors in same room or area shall be matched for color and grain.

2. Doors for Opaque Finish: NAAWS 4.0 Section 04, Grade A, Fir or Pine.

E. Joinery: Engineered.

F. Stile, Rail and Mullion Dimensions:

1. Widths: As indicated or as standard with door manufacturer.

G. Stile, Rail and Mullion Construction: Solid lumber.

H. Raised Wood Panels:

1. Panel Construction: Raised, 2-ply solid lumber or 3-ply solid lumber.

2. Sticking: As indicated or as selected by the Architect.

3. Panel Thickness: Minimum 1-5/8-inch.

I. Glass or Flat Wood Panels:

1. Sticking: As indicated or as selected by the Architect.

2. Glass: As indicated and as specified in Section 08 80 00.

3. Flat Wood Panels: 5/8-inch thick, any of the following:

a. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2, faced with MDO.

b. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, faced with MDO.

c. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade 130, faced with MDO.

d. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin

J. Doors shall be glued-up with Type I or Type II adhesive, at manufacturer's option.

K. Factory Finishing:

1. Doors to be Field Painted: Prime paint doors suitable for field painting as specified in Section 09 91 00. Seal cut-outs, edges, and other surfaces not otherwise finished.

2. Transparent Finish Doors: Prefinish to match Architect approved samples as follows:

a. Standard: NAAWS 4.0 Section 05.

b. NAAWS 4.0 Grade: Premium.

c. NAAWS 4.0 Finish System: Section 05 – System 11, Catalyzed Polyurethane.

d. Wash Coat: Reduced vinyl sealer at stained finish.

e. Stain: Match approved sample for color.

f. Sealer: Vinyl.

g. Finish: Two topcoats in sheen to match approved sample.

h. Doors shall be labeled by ITS-WH, QAI or other listing agency approved by authorities having jurisdiction.

2.01 EXTERIOR STILE AND RAIL WOOD DOORS

A. Approved Manufacturer: Masonite Architectural "Aspiro Series | Harring" Exterior Application or approved equal.

B. Panel Design: As indicated.

C. Wood Species:

1. Transparent Finished Doors: Wood veneer species to be selected by the Architect, minimum 1/8-inch thick.

2. Opaque Finished Doors: Vertical Grain Douglas Fir stiles and rails with plywood or solid wood panels.

D. Stile, Rail and Mullion Dimensions:

1. Widths: As indicated or as standard with door manufacturer.

2. Thickness: 1-3/4-inches unless otherwise indicated.

E. Joinery: Cope and stick, doweled.

F. Stile, Rail and Mullion Construction:

1. Stiles: SCLC.

2. Top, Bottom, Lock, and Mid Rail: Solid lumber.

G. Raised Wood Panels:

1. Panel Construction: Raised, 2-ply solid lumber or 3-ply solid lumber, 1-5/8-inch thick.

2. Sticking: As indicated or as selected by the Architect.

H. Flat Wood and Glass Panels:

1. Sticking: As indicated or as selected by the Architect.

2. Glass: As indicated and as specified in Section 08 80 00.

3. Wood Panels: Medium density fiberboard (MDF), 5/8-inch thick.

4. Doors shall be glued up with Type I adhesive.

I. Factory Finishing:

1. Doors to be Field Painted: Prime paint doors suitable for field painting as specified in Section 09 91 00. Seal cut-outs, edges, and other surfaces not otherwise finished.

2. Transparent Finish Doors: Prefinish to match Architect approved samples as follows:

a. Standard: NAAWS 4.0 – Section 05.

b. NAAWS 4.0 Grade: Premium.

c. NAAWS 4.0 Finish System: Section 05 – System 11, Catalyzed Polyurethane.

d. Wash Coat: Reduced vinyl sealer at stained finish.

e. Stain: Match approved sample for color.

f. Sealer: Vinyl.

g. Finish: Two topcoats in sheen to match approved sample.

2.04 FABRICATION

A. Fabricate stile and rail wood doors in sizes indicated for either job-site fitting or factory fit doors to suit frame-opening sizes indicated, at Contractor's option. Factory-fit doors shall comply with the following uniform clearances and bevels:

1. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8-inch at jambs and heads, 1/16-inch per leaf at meeting stiles for pairs of doors, and 1/2-inch from bottom of door to top of floor finish. Where threshold is indicated, provide 3/8-inch clearance from bottom of door to top of threshold.

2. Fitting Clearances for Fire-Rated Doors: Comply with IBC Chapter 7 and NFPA 80.

3. Bevel non-fire-rated doors 1/8-inch in 2-inches (3-1/2 degrees) at lock and hinge edges.

4. Bevel fire-rated doors 1/8-inch in 2-inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling authority.

B. Factory-premachine stile and rail wood doors for hardware; comply with final hardware schedule, door frame shop drawings and hardware templates.

C. Glazed Openings: Factory-preglaze doors for applications indicated. Comply with requirements of Section 08 80 00. Trim glazed openings with solid wood moldings of profile indicated removable one side.

D. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish and quality of construction.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installed door frames prior to hanging doors. Verify that frames comply with specified requirements and have been installed with plumb jambs and level heads.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install stile and rail wood doors in compliance with manufacturer's instructions and NAAWS 4.0 Section 14.

B. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as specified; do not trim stiles and rails exceeding limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Fitting Clearances for Non-Rated Doors: Provide 1/8-inch at jambs and heads, 1/16-inch per leaf at meeting stiles for pairs of doors, and 1/8-inch from bottom of door to top of finish floor covering. Where thresholds occur, provide 1/4-inch clearance from bottom of door to top of threshold.

2. Bevel doors 1/8-inch in 2-inches at lock and hinge edges.

3. Hang doors within 1/16-inch of the height and width of the door assembly.

4. Pairs of doors, when closed, shall be within 1/16-inch of flush at the meeting edge.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Fire-Rated Doors: Install in fire-rated door frames in accordance with NFPA Standard No. 80.

3.03 ADJUSTING AND PROTECTION

A. Operation: Re-hang or replace doors which do not swing or operate freely.

B. Protect doors as recommended by door manufacturer to ensure that doors are without damage at time of Substantial Completion.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing access doors at all required locations.

B. Related Sections:

1. Gypsum board is specified in Section 09 29 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions, and directions for installation of anchorage devices. Include complete schedule including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions and other data pertinent to installation.

C. Location Drawing: Required access doors may not be indicated on the Drawings. Show proposed location of every required access door with dimensions in plan and elevation. Verify locations with the Architect. Access doors shall be located within walls and ceilings for access including but not limited to the following: automatic valves, automatic dampers, air terminal units, and fire/smoke dampers. Show location of adjacent materials, trim pieces, and hardware required to complete the work. Do not begin installation until the location is approved. Submit access door locations superimposed on piping layout and duct layout shop drawings.

1.03 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Units shall comply with NFPA 80, be identical to door and frame assemblies tested for fire-test-response characteristics, and are labeled and listed by UL, Warnock Hersey, or other testing and inspecting agency acceptable to authorities having jurisdiction.

1.04 COORDINATION

A. Furnish inserts and anchoring devices required to be built into other work. Coordinate delivery to avoid delay.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver and store access doors in manufacturer's standard protective packaging.

C. Do not remove protective packaging until it is ready for installation.

D. Follow manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Furnish access doors of proper size for access to concealed equipment. Unless otherwise indicated, minimum size shall be 12-inch x 12-inch for hand access and minimum 18-inch x 18-inch for valve and actuator access and 24-inch x 24-inch for equipment access.

B. Non-Fire-Rated Access Doors with Exposed Trim at Non-public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Commercial grade cold-rolled steel with 16-gauge frame and 14-gauge door.

4. Finish: Phosphate dipped with baked-on rust-inhibitive gray primer.

5. Exposed Trim: 1-inch flange overlapping surfaces surrounding door frame.

6. Hinge: Manufacturer's standard concealed pin hinge mechanism or continuous piano hinge.

7. Latch/Lock: Flush screwdriver operated stainless steel cam latch. Provide standard keyed locks at access doors located in public areas.

C. Non-Fire-Rated Access Doors with Exposed Trim in Custodial Rooms, Toilet Rooms, and other Wet Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Stainless steel, 16-gauge frame and 14-gauge door.

4. Finish: Satin polish finish.

5. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.

6. Hinge:

a. Areas Exposed to Public View: Concealed pin hinge mechanism. Exposed piano hinges are not acceptable.

b. Other Areas: Manufacturer's standard concealed pin hinge mechanism or continuous piano hinge.

7. Latch/Lock: Flush screwdriver operated stainless steel cam latch. Provide standard keyed locks at access doors located in public areas.

8. Provide insulated doors in insulated or acoustically rated construction.

D. Non-Fire-Rated Recessed Access Doors in Apartment Units and Public Areas:

1. Approved Manufacturer: Access Panel Solutions Bauco-Plus II or approved equal

2. Features:

a. Concealed aluminum frame and hardware.

b. Concealed mechanical touch latch.

c. Lift-out doors with safety cables.

d. Perimeter gasket for air and smoke tight fit.

3. Door Design: Touch-latch recessed panel to receive gypsum wallboard or other finish material as indicated.

4. Frame: Recessed aluminum extrusion. Frame acts as corner bead for finishing with 1/16-inch gape between frame and door.

5. Hinge: Free-pivoting hinge.

6. Latch: Concealed touch latch. Provide keyed lock where doors are within public reach.

7. Finish: Phosphate dipped with baked-on rust inhibiting primer for field painting as specified in Section 09 91 00.

8. Provide insulated doors in insulated or acoustically rated construction.

E. UL Fire-Rated Access Doors with Exposed Trim in Non-public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Commercial grade cold-rolled steel with 16-gauge frame and 20-gauge door.

4. Finish: Phosphate dipped with baked-on rust inhibiting primer.

5. Insulation: 2-inch-thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.

6. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.

7. Hinge: Manufacturer's exposed piano hinge.

8. Continuous Closer: Automatic spring closer to automatically close and latch door.

9. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have an interior latch release mechanism allowing the door to be unlocked from the inside. Provide standard keyed locks at access doors located in public areas.

F. UL Fire-Rated Access Doors with Exposed Trim at Custodial Rooms, Toilet Rooms, and Other Wet Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Stainless steel, 16-gauge frame and 20-gauge door.

4. Finish: Satin polish finish.

5. Insulation: 2-inch-thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.

6. Exposed Trim: Flange integral with frame, 3/4-inch wide, overlapping surrounding finished surface.

7. Hinge: Manufacturer's exposed piano hinge.

8. Continuous Closer: Automatic spring closer to automatically close and latch door.

9. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have an interior latch release mechanism allowing the door to be unlocked from the inside.

G. UL Fire-Rated Recessed Access Doors in Public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Recessed to receive gypsum wallboard or other finish material as indicated.

3. Material: Cold Rolled sheet steel, 16-gauge, recessed 5/8-inch.

4. Frame: 16-gauge cold rolled sheet steel with 22-gauge galvanized perimeter drywall bead.

5. Hinge: Manufacturer's exposed piano hinge.

6. Continuous Closer: Automatic spring closer to automatically close and latch door.

7. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have an interior latch release mechanism allowing the door to be unlocked from the inside. Provide standard keyed locks at access doors located in public areas.

8. Finish: Phosphate dipped with baked-on rust inhibiting primer for field painting as specified in Section 09 91 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install access doors in accordance with manufacturer's instructions.

B. Coordinate installation with the work of other Sections.

C. Set frames accurately in position and securely attach to supports with face panels plumb and level in relation to adjacent finish.

D. Frames, doors and trim pieces shall not vary from straightness or snug contact fit by more than 1/16-inch.

E. Coordinate location of access doors in hung ceilings, furred spaces and walls to provide access to concealed work items requiring maintenance and/or adjustment. Obtain approval of the Architect for the locations of such access doors.

F. Locate and group equipment requiring access doors. Coordinate location of equipment with other trades to minimize number of access doors in one area.

G. Provide access doors for maintenance or adjustment purposes for mechanical system components, including but not limited to the following:

1. Valves.
2. Dampers.
3. Concealed equipment.

3.02 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels and frames that are warped, bowed, dented, or otherwise damaged.

END OF SECTION

SECTION 08 34 83

ELEVATOR DOOR SMOKE CONTAINMENT SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Smoke detector activated elevator door smoke containment curtain and control system designed to provide a tight-fitting, smoke- and draft-control assembly.

B. Related Sections:

1. Non-structural metal framing is specified in Section 09 22 16.

2. Painting is specified in Section 09 91 00.

3. Electric traction elevators are specified in Section 14 21 00.

4. Smoke detectors are specified in Division 21.

5. Electrical is specified in Division 26.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product data.

C. Shop Drawings: Include door width and height, jamb width, jamb and head projection, curtain width, mounting height, and housing width. Show and identify related work performed under other Sections of the Specifications.

D. Qualifications: Documentation showing manufacturer and installer qualifications.

E. Certifications: Copy of specified items.

F. Manufacturer's installation instructions and testing procedures

G. Operation and maintenance manual.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Minimum 7 years' experience in producing smoke containment systems of the type specified.

2. Installer Qualifications: Factory trained by manufacturer.

B. Certifications:

1. Manufacturer's ICC ESR-1136 Evaluation Report.

2. Testing Laboratory Label.

3. UL Listing.

C. Pre-Installation Meeting:

1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Architect, Contractor, smoke containment system sub-contractor, painting sub-contractor, and electrical sub-contractor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.

3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Follow manufacturer's instructions.

1.05 OWNER'S INSTRUCTIONS

A. Maintenance and Testing:

1. Perform minimum semi-annual maintenance and testing on each smoke containment system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.

2. Retain permanent record of tests.

B. Future Painting: Paint auxiliary rails in accordance with Operation and Maintenance Manual.

C. Required Replacement: Smoke containment screen requires replacement following exposure to temperatures exceeding 200-degrees F.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Smoke Guard Corporation M400, ICC ESR-1136 or approved equal.

2.02 PERFORMANCE REQUIREMENTS

A. Air Leakage: Not to exceed 3-cfm/sq. ft. door opening at 0.1-inch water pressure differential at ambient temperature and 400 degrees F.

2.03 COMPONENTS

A. Curtain:

1. Film: Minimum 1-mil thick transparent polyimide film reinforced with minimum 100 denier Nomex yarn at .25-inch each way.

2. Magnetic Strips: Flexible multi-pole strips attached to longitudinal edges of film with low modulus silicone adhesive.

B. Housing: 20-gauge, powder coated, cold rolled steel container with dust cover and door with concealed hinges. Housings are 55-, 64- or 73-inches in length.

C. Auxiliary Rails: Provide non-ferrous hoistway frames, hoistway frames that do not have 2-inch-wide flat face or hoistway frames that are flush with finished wall.

1. Material: 16-gauge ASTM A 240/240M, Type 430, ferretic stainless steel.

2. Size: 2-inches wide, minimum 3/4-inch deep.

D. Rewind Motor: NFPA 70, 90v DC.

E. Provide manufacturer's FCC compliant battery backup system. Battery backup system is not required if smoke containment barriers are connected to emergency power.

F. Release Mechanism: Comply with UL Standard No. 864.

G. Screen Rewind Switch: Included switch to rewind curtain into housing.

H. Label each smoke containment system with following information:

1. Manufacturer's name.

2. Maximum leakage rating at specified pressure and temperature conditions.

3. Label of quality control agency.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed.

1. Verify related work performed under other sections is complete and in accordance with shop drawings.

2. Verify wall surfaces and elevator door frames are acceptable for installation of smoke containment system components.

3. Coordinate with the responsible entity to perform corrective work on unsatisfactory substrates.

B. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. Install smoke containment system components in accordance with manufacturer's installation instructions.

3.03 FIELD QUALITY CONTROL

A. Field Test: Follow manufacturer's cycle test procedures.

1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor, elevator sub-contractor, and elevator service company minimum one week in advance of scheduled testing.

2. Complete maintenance service record.

3.04 DEMONSTRATION

A. Demonstrate required testing and maintenance procedures to Owner's Representative.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing aluminum-framed entrances and storefronts, including exterior entrance doors, transoms, sidelights, fixed windows, and exterior storefront-type framing system.

B. Primary components of aluminum-framed entrances and storefronts include aluminum storefront framing, glass and glazing, sills and similar items indicated as integral components of the storefront system, joint sealants, flashings, anchors, shims, fasteners, accessories, and support brackets.

C. Related Sections:

1. Sheet metal flashing and trim is specified in Section 07 62 00.

2. Joint sealants are specified in Section 07 92 00.

3. Glazing is specified in Section 08 80 00.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed entrances and storefront systems, including compensating channels and sub-sills, complying with performance characteristics specified, as demonstrated by testing the manufacturer's corresponding stock assemblies according to specified test methods. Entrances and storefronts shall accommodate movements and tolerances of the building structure including but not limited to live load and dead load deflection, creep, seismic drift, and adjacent material tolerances.

B. Thermal Movement: Design the aluminum-framed entrances and storefronts to provide for expansion and contraction of the component materials resulting from a surface temperature range of 180-deg. F. without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects. Entrance doors and operable units shall function normally over the specified temperature range.

C. Wind Loads: Provide aluminum-framed entrance and storefronts, including anchorage, capable of withstanding wind-load design pressures calculated according to the requirements of IBC Chapter 16, and as indicated on Structural Drawings.

D. Structural Performance: Conduct tests for structural performance in accordance with ASTM E330. At the conclusion of the tests there shall be no glass breakage or permanent damage to fasteners, anchors, hardware, or actuating mechanism. Framing members shall have no permanent deformation exceeding 0.2-percent of their clear span.

1. Deflection Normal to Plane of the Wall: Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the specified wind load. Deflection shall not exceed 1/175 of the clear span, when subjected to uniform load deflection test.

2. Deflection Parallel to the Plane of the Wall: Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75-percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other fixed member above to less than 1/8-inch. The clearance between the member and an operable door or window shall be at least 1/16-inch.

E. Air Infiltration: Provide aluminum-framed entrances and storefronts with an air infiltration rate of not more than 0.06-cfm per sq. ft. of fixed area, excluding operable door edges, when tested in accordance with ASTM E283 at an inward test pressure differential of 6.24-psf (50-mph wind load).

F. Water Penetration: Provide storefront framing systems with no uncontrolled water penetration, excluding operable door edges, as defined in the test method when tested in accordance with ASTM E331 and E547 at an inward test pressure differential of 12-psf.

G. Water Management: Storefronts shall be designed and installed to allow for penetrating moisture to drain to the exterior. Provide end dams at sill flashing, water deflectors, sealed horizontal joints, weep slots and baffles, and other methods for water management. Show water management provisions on the shop drawings.

H. Thermally Improved Construction: Frames and sashes shall have an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Furnish product data and manufacturer's installation instructions for each system showing manufacturer's standard details and fabrication methods, data on finishing, hardware, and accessories, and recommendations for maintenance and cleaning.

C. Shop Drawings: Include for fabrication and installation, including large scale elevations, plans, full scale detail sections of typical members, anchors, reinforcement, expansion provisions, and glazing. Include full scale details at head, jambs, spandrels, sill and mullions for each opening.

1. Indicate interface with adjacent construction and flashings.

2. Reference window types indicated on architectural window type drawings.

3. Reference architectural elevation, plans, sections and details.

4. Reference structural details and members.

5. Indicate flashings, brake shape trim and closures.

6. Show details of intersections of frame caps.

7. Show building dimensions and proposed methods to accommodate live load deflections and column shortening.

8. Show relative layout of walls, beams, columns, and slabs. Indicate tolerances required for storefront installation that can be accommodated by the storefront system.

9. Show perimeter sealant joint sizes, including tolerances and minimum/maximum joint sizes required.

10. Show location of anchorage points and identification of the reaction loads imposed on the structure, including dead load and wind load reactions at each anchor location.

11. Include building elevations showing the wind loads for each portion of the building including corners and wall areas adjacent to corners.

12. Show insulation materials, firestopping and fire safing materials.

13. Show path for water drainage from the system. Show methods incorporated into the design to collect, control, contain and evacuate secondary water infiltration from glazing channels, perimeter surrounding conditions and perimeter joint sealants.

14. Include Project-specific installation instructions and details. Include perimeter framing joint conditions and internal joinery conditions. Indicate which framing members run thru, and how joints are to be sealed. Indicate sealant continuity notches used to prevent water infiltration by capillary action in the metal-to-metal joint and internal seals.

15. Coordinate submittal with glazing submittals.

C. Samples for Verification: Furnish two samples of each type and color of aluminum finish selected, on 12-inch long sections of extrusions or formed shapes and 6-inch square sheets.

D. Laboratory Test Reports: Furnish certified test reports from a qualified independent testing laboratory showing that aluminum-framed entrances and storefronts have been tested in accordance with specified test procedures and comply with specified performance characteristics. Where such testing has not been performed, test through an independent testing laboratory or agency and furnish certified test results.

E. Warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A minimum of 5-years' experience in the manufacture of aluminum-framed entrances and storefronts of the types specified.

B. Installer's Qualifications: Documented experience in the installation of systems like those required.

C. Single Source Responsibility: Provide aluminum-framed entrances, storefronts and operable windows produced by a single manufacturer.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver aluminum-framed entrances and storefronts in the manufacturer's original protective packaging.

C. Store aluminum components in a clean, dry location away from uncured concrete. Cover components with waterproof paper, tarp, or polyethylene sheeting in a manner to permit circulation of air.

1. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

1.06 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication with construction progress to avoid delay of the work.

1.07 WARRANTY

A. Furnish written warranty covering aluminum-framed entrances and storefronts that fail in materials or workmanship within 5-years from date of Substantial Completion. Failures include but are not limited to structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation, and deterioration of materials beyond normal weathering.

B. Warrant anodized finish to be free from defects in materials and workmanship for a period of 5-years from date of Substantial Completion.

C. Warrant fluoropolymer finish to be free from defects in materials and workmanship as defined for a period of 20-years from date of Substantial Completion.

D. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Kawneer Company, Arcadia, Inc., Oldcastle BuildingEnvelope, CRL / US Aluminum or approved equal.

2.02 MATERIALS

A. Aluminum Members: 6063-T5 alloy and temper.

B. Fasteners: Series 300 nonmagnetic stainless steel.

1. Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws countersunk flush that match the finish of member or hardware item being fastened.

C. Concealed Flashing: Dead-soft stainless steel or extruded aluminum as selected by manufacturer for compatibility with other components.

D. Brackets and Reinforcements: Aluminum or nonmagnetic stainless steel. Provide non-staining, non-ferrous shims for installation and alignment as required.

E. Weatherstripping: Manufacturer's standard replaceable type. Provide weatherstripping on meeting stiles of pairs of doors and at bottom rail of each door leaf.

F. Framing System Gaskets: Compression type, replaceable, molded, or extruded, of profile and hardness required to maintain watertight seal.

G. Sealants: Manufacturer’s standard, recommended by manufacturer for joint type.

2.03 COMPONENTS

A. Storefront Framing Systems: Provide storefront and entrance framing systems fabricated from extruded aluminum members of size and profile indicated. Include sub-frames and other reinforcing members as required. Shop-fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.

1. Mullion Configuration: Provide pockets at the inside glazing face to receive resilient elastomeric glazing. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior.

2. Mullion Size: As indicated.

B. Stile-and-Rail Type Entrance Doors: Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration and fillet welds.

1. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.

2. Design: As indicated.

3. Each door leaf shall be equipped with an adjusting mechanism located in the top rail near the lock stile, which provides for minor clearance adjustments after installation.

C. Miscellaneous Brake Shapes: Provide headers, closures, anchors and supports, including gypsum board adapters, as indicated, and required. Fabricate from minimum 0.090-inch aluminum unless otherwise indicated.

2.04 FABRICATION

A. General: Fabricate aluminum-framed entrances and storefronts to designs, sizes and thicknesses indicated, and to comply with specified standards. Sizes and profile requirements are indicated.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Provisions for field replacement of glazing from interior or exterior as standard for installed storefront framing.

6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site. Disassemble components only where necessary for shipment and installation.

1. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.

2. Do not drill and tap for surface-mounted hardware items until time of installation at Project site.

D. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.

1. Welding behind finished surfaces shall be performed to minimize distortion and discoloration on the finished surface.

E. Reinforcing: Install reinforcing as required for hardware, performance requirements, sag resistance and rigidity.

F. Dissimilar Metals: Separate dissimilar metals with bituminous paint, suitable sealant, elastomeric tape, or gasket between the surfaces. Do not use coatings containing lead.

G. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.

H. Conceal fasteners wherever possible.

I. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops. At other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

J. Provide miscellaneous aluminum brake metal closures and flashings as indicated, finished to match aluminum-framed entrances and storefronts.

2.05 FINISHES

A. Exposed surfaces shall be free of scratches and other blemishes.

B. Where a color anodized finish is indicated or selected, exposed surfaces shall be finished with a Class I integral or electrolytically deposited color anodized finish conforming to AA-M12C22A42/A44, color as selected by the Architect from within standard industry colors and color density range.

C. Where a clear anodized finish is indicated or selected, exposed surfaces shall be finished with a Class I clear anodized finish conforming to AA-M12C22A41.

D. Where a Kynar finish is indicated or selected, exposed surfaces shall be finished with a full-strength 70-percent “Kynar 500” or “Hylar 5000” coating baked on for 15-minutes at 450-deg. F. to dry film thickness of 1.0-mil over 0.3-mil baked on epoxy primer. Custom color to match color sample furnished by the Architect.

1. Finish shall have been field tested under normal range of weathering conditions for minimum of 20-years without significant peel, blister, flake, chip, crack, or check in finish; without chalking exceeding No. 8 in accordance with ASTM D659; and without fading exceeding 5 NBS units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions with installer present, for compliance and requirements for installation tolerances and other conditions affecting performance of the work.

B. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation.

B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines. Provide proper support and anchor securely in place.

C. Installation Tolerances:

1. Variation from Plane: Do not exceed 1/8-inch in 12-feet of length or 1/4-inch in any total length.

2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end-to-end in line shall not exceed 1/16-inch.

3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8-inch.

4. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32-inch.

D. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

1. Paint dissimilar metals where drainage from them passes over aluminum.

2. Paint aluminum surfaces in contact with mortar or concrete with alkali-resistant coating.

3. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subjected to wetting, with 2-coats of aluminum house paint. Seal joints between the materials with sealant.

E. Drill and tap frames and doors and apply surface-mounted hardware in compliance with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

F. Set sill members and other members in bed of sealant or use joint fillers or gaskets to provide weathertight construction. Comply with the requirements of Section 07 92 00.

G. Where flashings are indicated adjacent to work specified in this Section, provide flashings in 0.040-inch aluminum unless otherwise indicated, finished to match entrances and storefronts.

H. Set miscellaneous brake shapes flush with hairline joints to adjacent storefront systems.

3.03 ADJUSTING

A. Adjust operating hardware to function properly for smooth operation without binding, and to prevent tight fit at contact points and weatherstripping.

3.04 CLEANING

A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

B. Clean glass surfaces after installation, complying with the requirements specified in Section 08 80 00. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.05 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

B. Provide adhered, non-marring strippable plastic protection over all framing members at time of installation, prior to glazing.

END OF SECTION

SECTION 08 51 26

HOT-ROLLED STEEL WINDOWS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes hot-rolled steel windows where new windows are indicated. Hot rolled steel windows shall match the appearance of the existing historic windows.

B. Related Sections:

1. Exterior building restoration and cleaning is specified in Section 01 35 91.

2. Joint sealants are specified in Section 07 92 00.

3. Glazing is specified in Section 08 80 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Samples:

1. Typical sash corner.

2. Color sample of finish for verification purposes.

C. Shop Drawings and Manufacturer's Literature:

1. Shop drawings showing window and installation details, including anchorage, fastening and sealing methods.

2. Dimensioned elevations showing window opening and window sizes.

1.03 QUALITY ASSURANCE

A. Manufacturer: Minimum 5 years' experience in the manufacture of hot rolled steel windows.

B. Installer: Minimum 3 years' experience in the installation of steel windows.

C. Allowable Tolerances: Size dimensions +/- 1/16-inch.

D. Source Quality Control:

1. Air Infiltration Test, ASTM E283: Maximum air infiltration of 0.06-cfm per sq. ft. of wall area or 0.37-cfm per linear foot of crack length.

2. Water Penetration Test, ASTM E331: No water penetration for 15 minutes when window is subjected to a rate of flow of 5-gal./hr./sq. ft. with differential pressure across window unit of 6-psf.

3. Structural Performance, ASTM E330: No failure of locks, hinges or other parts at a positive or negative pressure of 60-psf (150-percent Design Load).

4. Upon request, the window manufacturer shall provide a test report from a qualified independent testing laboratory regularly engaged in testing windows to verify that his products conform to these test requirements.

1.04 PRODUCT, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Store in designated areas in an upright position on wood slats or on a dry floor in a manner that will prevent damage. Ventilate canvas or plastic coverings to prevent humidity buildup.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURER

A. Torrance Steel Window Co., Inc. or approved equal.

2.02 MATERIALS

A. Hot rolled steel windows shall be manufactured from solid hot rolled steel shapes made from new billet steel with glazing flanges rolled integral at the mill.

B. Glazing beads shall be extruded alloy 6063-T5 with a thickness of not less than 0.040-inch.

2.03 FABRICATION

A. Fabricate steel windows in accordance with approved shop drawings. Profiles and dimensions shall match existing historic steel windows and shall be approved by the Architect.

1. Where possible, parts from existing hot rolled steel windows to be demolished or reconfigured shall be used in the fabrication of new windows.

B. Corners of the frame and ventilators shall be coped or mitered and electrically welded. Exposed surfaces dressed smoothly.

C. Muntin bars shall be attached to frame or ventilator members by means of mortise and tenon joints, with intersections interlocked and welded with flush interior surfaces.

D. Vents shall be prepared for screens.

E. Hardware: Operators shall be heavy-duty roto operators finished to match sash. Operators shall match the appearance of the operators on the existing historic windows.

F. Projected ventilators shall be balanced on two heavy steel supporting arms concealed when the ventilator is closed. Friction shall be provided by solid bronze, non-ferrous shoes, spring-loaded and mounted in housing at the top rail of each ventilator. Provide stops to limit the amount of opening.

G. Project-out ventilators shall have a cam type locking and handle engaging a strike.

H. Project-in ventilators within reach of the floor shall have a cam type locking handle engaging a concealed keeper.

I. Project-out casement ventilators shall have a heavy-duty roto operator or a #116 cam lock with the tongue engaging in a lead strike. Side hinged ventilators up to 5'-4" high shall be hung on two heavy steel extension hinges and shall be arranged to swing out. Vents over 5'-4" high shall have English Type steel hinges and two locking handles. Drips shall be attached to the frame at head of out-swing ventilators.

J. Weatherstripping: Windows shall be continuously weatherstripped around the entire perimeter of the ventilators. Joints or intersections of the weatherstripping shall be tightly and securely closed to provide full pressure equalization in the ventilator chamber. Weatherstripping shall be in the same plane. Weatherstripping shall be bulb-type, thermoplastic with vinyl/rubber compound.

K. Glazing: Windows shall be designed for glazing from inside, with continuous snap-in glazing beads.

L. Screens: Opened frame type design arranged for attachment and removal from the inside. Screens shall have aluminum frames with aluminum screen cloth. Screen frames shall be finished to match windows.

M. Finishing:

1. After fabrication, windows, mullions, covers and trim shall be zinc phosphate treated in a five-stage process.

2. Following pretreatment apply one coat of primer and finish coat to match approved sample.

PART 3 - EXECUTION

3.01 INSPECTION

A. Window openings shall conform to details, dimensions and tolerances shown on the window manufacturer's approved shop drawings.

B. Conditions which may adversely affect the window installation shall be corrected before installation commences.

C. Verify existing openings are in a condition acceptable to receive the new windows. Notify the Architect if existing opening conditions need to be repaired. Do not proceed with window installation until unsatisfactory conditions are corrected.

D. Complete wash down of the adjacent masonry before erection to prevent damage to the finish by the cleaning materials.

3.02 INSTALLATION

A. Install windows in openings in strict accordance with manufacturer's instructions and approved shop drawings.

1. Set units plumb, level and true to line, without warp or rack of frames.

2. Anchor units securely to surrounding construction with approved fasteners.

3. The exterior joints between the sash, trim and mullions shall be properly sealed watertight with an approved sealant and neatly pointed.

B. Repair abraded areas of the factory finish.

3.03 CLEANING

A. Leave window surfaces clean after installation and ready to receive glass and glazing.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for interior and exterior glass and glazing.

B. Related Sections:

1. Hollow metal doors are frames are specified in Section 08 11 13.

2. Hot rolled steel doors are specified in Section 08 13 76.

3. Flush wood doors are specified in Section 08 14 16.

4. Stile and rail wood doors are specified in Section 08 14 33.

5. Aluminum framed entrances and storefronts are specified in Section 08 41 13.

6. Hot rolled steel windows are specified in Section 08 51 26.

1.02 DEFINITIONS

A. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating resulting from seal failure, and any other visual evidence of seal failure or performance.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.

B. Normal thermal movement is defined as that resulting from an ambient temperature range of 120-deg. F. and from a consequent temperature range within glass and glass framing members of 180-deg. F.

C. Provide heat strengthened glass lites where recommended by glass manufacturers as determined by glass stress analysis calculations based on glass unit sizes indicated and shading patterns occurring on the glass. Furnish copies of the glass stress analysis calculations and show the location of glass units required to be heat strengthened on the shop drawings.

D. Surface and Optical Distortion Requirements:

1. Roll Wave: Maximum 0.003-inch (central area) and +/- 100 millidiopter over 95-percent of glass surface.

2. Leading and Trailing Edge: Maximum 0.008-inch lead and trail edge (edges = 12-inches) of glass surface. Maximum 0.006-inch for glass to be laminate3d.

3. Center Kink: 0.001-inch measured perpendicular to direction of travel, +/- 70X millidiopter.

4. Bow and Warp: Maximum localized and overall bow (warp) per lite shall be 0.031-inch per lineal foot; one-half of maximum allowed by ASTM C1048.

1.04 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.

C. Samples: 12-inch square samples of each type of glass indicated and specified except for clear single pane units, and 12-inch long samples of each type of sealant or gasket exposed to view.

D. Shop Drawings: Show location of exterior glass units required to be heat strengthened based on glass stress analysis calculations.

E. Warranty.

1.05 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of the following manufacturer and associations except where more stringent requirements are specified:

1. Glass Association of North America (GANA) "Glazing Manual" and "Sealant Manual".

2. Sealed Insulating Glass Manufacturers Association (SIGMA): TM-3000 "Vertical Glazing Guidelines".

B. Safety Glass: Where safety glass is indicated or required, provide products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

C. Insulating Glass Certification Program: Provide insulating glass units permanently marked with appropriate Insulating Glass Certification Council (IGCC) certification label.

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that required for this Project, with a record of successful in-service performance.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Protect glazing materials during delivery, storage, and handling; comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture, temperature changes, direct exposure to sun and from other causes.

1.07 PROJECT CONDITIONS

A. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when glazing channel substrates are wet.

B. Install glazing sealants at ambient and substrate temperatures above 40-deg. F.

1.08 WARRANTY

A. Insulating Glass: Furnish written warranty signed by glass manufacturer, agreeing to furnish replacements for those insulating glass units developing manufacturing defects as defined, within 10-years from date of Substantial Completion.

B. Mirror Glass: Furnish written warranty agreeing to furnish replacement mirrors for those units developing silver spoilage within 15 years from date of Substantial Completion.

C. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS

A. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Thickness as indicated, specified, or recommended by glass manufacturer.

B. Manufacture heat-treated glass by horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed.

2.02 GLASS TYPES

A. Clear Insulating Glass with Low E Coating: Cardinal Glass Industries "LoE^3-366" or approved equal insulating glass with Low E coating and argon fill, tempered where indicated or required by code. Glass thicknesses as indicated or as standard with door and window manufacturer.

B. Clear Tempered Float Glass: 1/4-inch-thick clear tempered float glass.

C. Fire-Rated Glass:

1. Fire-Rated Clear Glass at Non-Impact Safety-Rated Locations: Fire-rated, laminated, clear and wireless glass ceramic with premium polished surface finish, 5-mm (nominal 3/16-inch) thick, "FireLite" as manufactured by the Nippon Electric Glass Co. Ltd., or approved equal. Product shall be UL listed and labeled as fire resistant with hose stream test and NFPA 80 and UL 9 or NFPA 257 test standards for fire-ratings scheduled.

2. Fire-Rated Clear Safety Glass at Impact Safety-Rated Locations: "FireLite Plus" fire-rated, laminated, impact safety-rated, clear and wireless glass ceramic with premium polished surfaces, 8-mm (5/16-inch) thick, as manufactured by the Nippon Electric Glass Co. Ltd., or approved equal. Product shall be UL listed and labeled as fire resistant with hose stream test and shall meet CPSC 16 CFR Part 1201 and ANSI Z97.1 test requirement and NFPA 80 and UL 9 or NFPA 257 test standards for fire-ratings scheduled.

3. Fire-Rated Radiant Barrier Clear Safety Glass: Pilkington Group "Pilkington Pyrostop", distributed by Technical Glass Projects, fire-rated, impact safety-rated, clear and wireless glazing material consisting of multiple sheets of "Optiwhite" high visible light transmission glass laminated with intumescent interlayer. Product shall be UL listed and labeled as fire resistant with hose stream test and shall meet CPSC 16 CFR Part 1201 and ANSI Z97.1 test requirements and ASTM E119, NFPA 80, NFPA 251, UL 10C or NFPA 252, UL 9 or NFPA 257, and UL 263 test standards for fire-ratings scheduled.

4. Fire-Rated Insulating Glass Units: Technical Glass Products "FireLite IGU" or approved equal.

D. Mirror Glass: 1/4-inch-thick glass mirrors in single piece units for each location. Where multiple pieces are required, joint locations shall be approved by the Architect.

2.03 ELASTOMERIC GLAZING SEALANTS

A. General: Comply with recommendations of sealant and glass manufacturer's for selection of glazing sealants with performance characteristics suitable for applications indicated and conditions at time of installation.

1. Compatibility: Select sealants with proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.

3. Colors: Color of exposed sealant as selected by Architect from manufacturer's standards.

B. Silicone Glazing Sealant: One-part elastomeric silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A and 0 as applicable; Dowsil “999”, GE "SCS 1200", Rhone-Poulenc, Inc. "Rhodorsil 3B", Tremco "Proglaze" or approved equal.

C. Glazing Sealant for Fire-Rated Glass: Rectorseal “Metacaulk 835+”, DAP 1012 or approved equal, listed and approved by UL, Warnock Hersey or approved testing agency.

2.04 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100-percent, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged in rolls with a release paper backing, complying with AAMA 800.

B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

C. Glazing Tape for Fire-Rated Glass: EPDM or other approved flame-resistant gasket material approved by testing agency.

2.05 GLAZING GASKETS

A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded neoprene, EPDM, or silicone gaskets of profile and hardness required to maintain watertight seal; complying with ASTM C864, D.S. Brown Co., Maloney, Tremco or approved equal.

B. Soft Compression Gaskets: Extruded or molded closed cell, integral-skinned neoprene, EPDM, or silicone of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II, black; D.S. Brown Co., Maloney, Tremco or approved equal.

2.06 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Provide materials with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Neoprene, EPDM or silicone blocks as required, 80 to 90 Shore A durometer hardness.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement.

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-staining, non-extruding, non-outgassing, strips of closed-cell plastic foam of density, site, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Mirror Mastic: Palmer Products "Mirro-Mastic", TAP Plastics “Gunther Premier Plus” or approved equal for securing glass mirrors.

2.07 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect work for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; presence and functioning of weep system on framing having weeps; existence of minimum required face or edge clearances; and for effective sealing of joinery. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members to receive glass. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are to be used.

3.03 GLAZING, GENERAL

A. Comply with printed recommendations of glass, sealants, gaskets, and other glazing materials manufacturers.

B. Coordinate with framing system manufacturers for proper glazing channel dimensions to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with acceptable tolerances.

C. Protect glass from edge damage during handling and installation.

1. Use a rolling block in rotating glass units to prevent damage to corners. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening.

2. Remove and dispose of glass units with edge damage or other imperfections of a kind that would weaken glass when installed and impair performance and appearance.

D. Apply primers to joint surfaces where required for sealant adhesion.

E. Install setting blocks of proper size in sill rabbet, located to comply with referenced glazing standard. Set blocks in thin course of sealant.

F. Provide spacers inside and out, of size and spacing to preserve required face clearances for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking to comply with requirements of referenced glazing standard except where otherwise required by glass unit manufacturer.

H. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tape to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tape to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each lite is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward center of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past the face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.07 PROTECTION AND CLEANING

A. Protect glass from breakage. Do not apply markers to the surfaces of glass. Remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances. Remove immediately by methods recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction for build-up of dirt, scum, alkali deposits or staining. Remove as recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged during construction, including natural causes, accidents, and vandalism.

E. Wash glass on both faces not more than 4-days prior to date scheduled for inspection for Substantial Completion. Use methods recommended by glass manufacturers.

END OF SECTION

SECTION 09 28 13

CEMENTITIOUS BACKING BOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes cementitious backing boards. Extent of cementitious backing boards includes:

1. Backing board for tiled walls.

2. Setting materials for installation of tile backer boards.

B. Related Sections:

1. Elastomeric liquid waterproofing is specified in Section 07 14 17.

2. Acoustical joint sealants are specified in Section 07 92 19.

3. Gypsum board is specified in Section 09 29 00.

4. Tile is specified in Section 09 30 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's data for each type of component and system specified, including details of construction, materials, and installation instructions.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in their original unopened packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

C. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack cementitious backing board to prevent sagging. Stack flat, on continuous surface, and without skids.

D. Handle cementitious backing boards to prevent damage to edges, ends or surfaces. Remove damaged or deteriorated materials from site.

1.04 PROJECT CONDITIONS

A. Cold Weather Protection: In cold weather, maintain continuous, uniform, building temperatures of not less than 45-deg F. or more than 100-deg. F. for a minimum period of 48-hours prior to, during, and following cementitious backing board and tile installation.

B. Conditioning: Store cementitious backing board in spaces where it is to be installed for 48 hours prior to installation. Do not install the backing board when it is wet.

C. Ventilation: Ventilate building spaces as required to remove excess moisture.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURER

A. United States Gypsum Company “DUROCK Brand Cement Board”, James Hardie Building Products “HardieBacker”, Custom Building Products “WonderBoard” or approved equal.

2.02 MATERIALS

A. Cementitious Backing Board: Aggregated portland cement board with vinyl-coated, woven glass-fiber mesh embedded in back and front surfaces.

1. Thickness: 1/2-inch and 5/8-inch.

2. Faces: Smooth on one side, textured on other side.

3. Edges: Formed smooth edges; square cut ends.

4. Weight: 3 pounds per square foot.

5. Flexural Strength, ASTM C947:

a. 5/8-inch Thick Board: >480-psi.

b. 1/2-inch Thick Board: >750-psi.

6. Nail Pull Resistance: >90, ASTM C473.

7. Water Absorption: 15-percent by wt., 24-hours, ASTM C473.

8. Flame-Spread, Smoke Developed: 0, 0 respectively, in accordance with ASTM E84.

9. Non-combustibility: Pass, ASTM E136.

10. Mold Resistance: No growth, ASTM G21.

B. Joint Reinforcement: Glass-fiber tape, vinyl coated, open-weave tape; 2-inches wide; pressure-sensitive.

C. Fasteners: Self-drilling screws with corrosion resistant finish.

1. At Cementitious Backing Board: Screws with flat wafer head capable of being driven flush to surface of tile backer board; 1- 1/4-inch long.

2. When cementitious backing board is installed over gypsum board base layer, screws shall be 1-5/8-inches long.

D. Water Barrier: Vapor permeable membrane, 15 lb. asphalt felt or TYVEK building paper by E.I. du Pont de Nemours & Company.

E. Setting Materials: Latex-portland cement mortar complying with ANSI A118.4.

F. Joint Compound: Setting type or Lightweight Setting Type Joint Compound.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and framing for compliance with requirements and conditions affecting the work of this Section. Do not proceed with installation until piping, waterproofing, and other in-wall work has been installed and accepted by Architect and unsatisfactory conditions have been corrected.

B. Examine adjacent construction for conditions which could contribute to loss of sound attenuation.

3.02 GENERAL

A. Comply with manufacturer's printed installation instructions applicable to products and applications indicated, except when more stringent requirements apply.

B. Before installation, cut cementitious backing backer boards to required sizes, make necessary cut-outs for penetrations, and grind or drill to provide relief at bolts and screw heads which project beyond face of substrate.

C. Control Joints: Do not install cementitious backing board continuously through building movement and control joints or where control joints are required in ceramic tile.

3.03 PARTITIONS

A. Framing: Install cementitious backing board over framing type indicated. Install blocking to support plumbing fixtures, and to receive soap dishes, grab bars, towel bars, and other accessories and hardware.

B. Water Barrier: Install over framing at showers prior to application of cementitious backing boards. Lap joints to shed water towards face of partition. The bottom edge shall overhang lip of tub, shower pan, or shower receptor.

C. Apply cementitious backing boards to framing with long dimension parallel to or across framing. Fit ends and edges closely but not forced together. Center end or edge joints on framing and stagger joints in adjacent rows.

E. At shower pans, place temporary 1/4-inch spacer strips around lip of fixture. Install cementitious backing board abutting the top of spacer. Remove spacer before installing tile and fill joint with joint sealant. Joint sealants are specified in another section.

F. Fasten cementitious backing board to framing. Locate screws at least 3/8-inch from edge of board and spaced 8-inches on center.

3.04 JOINT TREATMENT

A. Tiled Surfaces: Apply joint reinforcing over joints and corners. Embed with mortar or adhesive used to set tile.

B. Un-Tiled Exposed or Painted Surfaces: Install cementitious backing board with smooth side exposed. Seal cementitious backing board with sealer. Apply tape over joints. Embed joint tape and treat fasteners with joint compound. Flat trowel a skim coat of joint compound over cementitious backing board to fill voids. Sand to provide a smooth surface except where a textured finish is indicated. Finish joints with at least two coats of finishing compound. Install corner beads at outside corners.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Gypsum board and associated accessories.

B. Related Sections:

1. Firestopping is specified in Section 07 84 00.

2. Acoustical joint sealants are specified in Section 07 92 19.

3. Cementitious backing boards are specified in Section 09 28 13.

4. Acoustic insulation is specified in Section 09 81 00.

5. Painting is specified in Section 09 91 00.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications and installation instructions for each type of gypsum board and accessory required.

1.03 QUALITY ASSURANCE

A. Manufacturer: Gypsum board, including accessories and fasteners, shall be the products of the same manufacturer.

B. Gypsum board work shall comply with ASTM C840 and IBC Section 2508 unless otherwise indicated or specified.

C. Installation and finishing of gypsum board shall comply with GA-216. Installation of fire-rated gypsum board shall comply with their listing descriptions indicated on the Drawings.

D. Fire-Resistance Ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and installations identical with those of applicable assemblies tested in accordance with ASTM E119 by fire testing laboratories acceptable to authorities having jurisdiction.

1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No's. in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

E. Allowable Tolerances:

1. Gypsum board surfaces shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8-inch in 10-feet when a straightedge is laid on the surface in any direction. Specified tolerances apply to both plumbness of walls and levelness of ceilings.

2. Shim the work as required to comply with specified tolerances.

3. Do not exceed 1/16-inch offset between planes of abutting sheets at edges or ends.

F. Mock-up: Install mock-up using approved gypsum products, including fasteners and related accessories, in accordance with manufacturer's instructions and recommendations.

1. Size: 100 square feet.

2. Prepare mock-up for each level of exposed gypsum board finish.

3. Approved mock-up may remain as part of the work.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Delivery:

1. Deliver materials to the Project site in original package containers or bundles with manufacturer's labels intact and legible.

2. Deliver fire-rated materials bearing the testing agency's label and classification identification.

C. Storage:

1. Store materials indoors in a dry area, under cover, and stacked flat off the floor.

2. Stack gypsum boards so that long lengths are not over short lengths.

D. Handle gypsum board to avoid damaging the face and edges of sheets.

E. Protect metal corner beads and trim from being bent or damaged.

1.05 PROJECT CONDITIONS

A. Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations.

B. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40-deg. F. For adhesive attachment and finishing of gypsum board, maintain not less than 50-deg. F. for 48-hours prior to application and continuously thereafter until drying is complete.

C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

D. Provide continuous ventilation during installation, using as close to 100-percent outside air as possible.

E. Protect workers and HVAC system from gypsum dust.

F. Remove and replace gypsum board products that are exposed to water and display mold and mildew. Removal shall occur as soon as possible after exposure to water.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD

A. Fire-Rated Gypsum Board: USG "Sheetrock Brand Firecode X Panels" or approved equal with tapered rounded edge to minimize ridging or beading and other joint imperfections.

1. ASTM C1396, regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.

2. Thickness: 5/8-inch.

3. Edges: Tapered long edges with face paper folded around the edge to reinforce and protect the core.

4. Provide USG “Sheetrock Brand Firecode C Panels” or approved equal where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.

B. Lightweight Fire-Rated Gypsum Board: USG “Sheetrock Brand EcoSmart Panels Firecode X” or approved equal lightweight enhanced proprietary Type X gypsum panels with noncombustible gypsum core encased in 100-percent recycled face and back papers.

1. ASTM C1396 for 5/8-inch and Type X gypsum board.

2. Edges: Tapered long edges with face paper folded around the edge to reinforce and protect the core.

3. Thickness: 5/8-inch.

4. Living Building Challenge Red List Free.

5. USDA Certified Biobased Product.

6. Achieved GreenGuard Gold Certification and qualifies as a low VOC emitting material meeting CA 01350.

C. Moisture-Resistant Fire-Rated Gypsum Board: USG “Sheetrock Brand Mold Tough Panels Firecode X” or approved equal noncombustible, moisture-resistant gypsum core encased in moisture- and mold-resistant, 100-percent recycled green face and brown back papers.

1. ASTM C1396 for 5/8-inch, Type X, water-resistant gypsum board.

2. Edges: Tapered long edges with face paper folded around the edge to reinforce and protect the core.

3. Thickness: 5/8-inch.

4. Achieved GreenGuard Gold Certification and qualifies as a low VOC emitting material meeting CA 01350.

5. Provide USG “Sheetrock Brand Mold Tough Panels Firecode C” or approved equal where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.

D. Lightweight Moisture-Resistant Fire-Rated Gypsum Board: USG “Sheetrock Brand EcoSmart Panels Mold Tough Firecode X” or approved equal noncombustible, moisture-resistant gypsum core encased in moisture- and mold-resistant, 100-percent recycled green face and brown back papers.

1. ASTM C1396 for 5/8-inch, Type X, water-resistant gypsum board.

2. Edges: Tapered long edges with face paper folded around the edge to reinforce and protect the core.

1. Thickness: 5/8-inch.

2. Living Building Challenge Red List Free.

3. Contains 100-percent USDA certified biobased content.

4. Achieved GreenGuard Gold Certification and qualifies as a low VOC emitting material meeting CA 01350.

E. Glass-Mat-Faced Moisture-Resistant Fire-Rated Gypsum Board for Early Dry-in: USG "Sheetrock Brand Glass-Mat Panels Mold Tough Firecode X" or approved equal noncombustible, moisture-resistant core encased in a fiberglass face and back.

1. ASTM C1658 for 5/8-inchy Type X and glass-mat water-resistant gypsum panel.

2. Thickness: 5/8-inch.

3. Edges: Tapered long edges with fiberglass face folded around the long edge to reinforce and protect the core.

4. Score 10 when tested in accordance with AST D3273.

5. Achieved GreenGuard Gold Certification and qualifies as a low VOC emitting material meeting CA 01350.

6. The installation of glass-mat-faced gypsum board will require the application of a Level 5 gypsum board finish as specified.

F. Glass-Mat-Faced, Abuse-Resistant, Moisture-Resistant, Fire-Rated Gypsum Board for Early Dry-in: USG "Sheetrock Brand Glass-Mat Panels Mold Tough AR Firecode X" or approved equal noncombustible, moisture-resistant core encased in a fiberglass face and back.

1. ASTM C1658 for 5/8-inch Type X and glass-mat water-resistant gypsum panel.

2. Thickness: 5/8-inch.

3. Edges: Tapered long edges with fiberglass face folded around the edge to reinforce and protect the core.

4. Tested to ASTM C1629 for surface abrasion and indentation resistance, and soft- and hard-body impact.

5. Score a 10 when tested in accordance with ASTM DE3273.

6. Achieved GreenGuard Gold Certification and qualifies as a low VOC emitting material meeting CA 01350.

7. The installation of glass-mat-faced gypsum board will require the application of a Level 5 gypsum board finish as specified.

G. Paperless Gypsum Board: USG "Fiberock Brand Aqua-Tough AR Interior Panel" or approved equal.

1. ASTM C1278 and C1629.

2. Mold Resistant, ASTM D3273: 10.

3. Thickness: 5/8-inch.

4. Provide behind prefabricated shower and bathtub enclosures and where indicated.

2.02 GYPSUM BOARD ACCESSORIES

A. Screws: ASTM C954 or ASTM C1002.

1. Use Type S screws for gypsum board attachment to light steel framing.

2. Use Type S-12 screws for gypsum board attachment to 20-gauge and heavier steel framing.

3. Use Type G screws for gypsum board attachment to gypsum board.

4. Use Type W screws for gypsum board attachment to wood framing.

B. Metal Trim:

1. Metal Corner Beads: USG “Sheetrock Brand Dur-A-Bead Corner Bead” or approved equal.

2. Paper-Faced Metal Casing Beads: USG “Beadex Brand Flex Metal Tape” or approved equal.

3. Control Joints: Roll-formed zinc with perforated flanges, 1-3/4-inch-wide with 1/4-inch-wide center channel with removable tape strip over channel.

C. Reveals: Extruded aluminum alloy 6063-T5, profiles indicated, finish as selected by the Architect.

D. Joint-Treatment Materials: ASTM C475.

1. Drying Type (Ready Mixed): USG “Sheetrock Brand All Purpose Joint Compound” or approved equal.

2. Setting Type (Chemically Hardening): USG “Sheetrock Brand Durabond 20 Joint Compound” or approved equal.

3. Lightweight Type: USG “Sheetrock Brand Plus 3 Joint Compound” or approved equal.

4. Dust Control Type: USG “Sheetrock Brand Dust Control Joint Compound” or approved equal.

E. Reinforcing Joint Tape: ASTM C475, 2-inch nominal width.

F. Acoustical Sheet Sealant Pad: Harry A. Lowry & Associates, 3M or approved equal.

G. Resilient Channels: ClarkDietrich “RC Deluxe Resilient Channel (RCSD)” or approved equal.

H. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

I. Primer/Surfacer: USG “Sheetrock Brand Tuff-Hide Primer-Surfacer” or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that conditions are satisfactory for the installation of gypsum board and accessories.

1. Check framing for accurate spacing, alignment, plumbness, and levelness. Verify that both new and existing framing members will result in gypsum board surfaces complying with specified tolerances.

2. Verify spacing of installed framing does not exceed maximum allowable for thickness of board to be used.

3. Verify door frames are set for thickness of board to be used.

4. Repair framing protrusions, twisted framing members, or unaligned members before installation of gypsum board commences.

B. Do not commence the installation until unsatisfactory conditions have been corrected.

3.02 APPLICATION OF GYPSUM BOARD

A. Apply materials in conformance with ASTM C840, the manufacturer's instructions, and as indicated.

B. When gypsum board is to be applied to both walls and ceilings, apply to ceilings first.

C. Resilient Channels:

1. Partitions: Apply resilient channels at right angles to framing. Position bottom channel with resilient channel attachment flange either up or down; position other channels with resilient channel attachment flanges down. Attach with 1-1/4-inch screws. Locate resilient channels 2-inches from floor, within 6-inches of ceiling, and not more than 24-inches on center.

2. Ceilings: Apply resilient channels at right angles to framing. Attach with 1-1/4-inch screws driven through channel attachment flange. For fire-rated, double-layer assembly, apply channels over base layer and attach with 1-7/8-inch screws driven through channel flange and base layer into joist. Fasten channels to joists at each intersection.

a. There shall be no contact with the free leg (flange) and the joist prior to the attachment of gypsum board.

b. There shall be no contact between the edge of the resilient channel and the framing.

c. The pre-drilled screw holes in the resilient channel shall be used.

d. Screws to attach the gypsum board to the resilient channel shall not be located below the joists.

e. The minimum number of screws required by code shall be installed through the gypsum board into the resilient channel.

D. For partitions, apply full height sheets with long dimensions parallel to framing members with abutting edges over supports. Where ceiling heights exceed 10'-0" and where required by fire resistive ratings, apply sheets with long dimension perpendicular to framing members. For ceilings, apply sheets with long dimension either perpendicular or parallel to framing members to result in fewest joints. For fire-rated assemblies, apply gypsum board in accordance with IBC Chapter 7.

E. Use sheets of maximum lengths to minimize end joints.

F. Neatly fit and stagger end joints.

G. Locate joints on different studs at opposite sides of partition.

H. Cut and fit neatly around outlets and switches. Back-to-back wall penetrations shall be at least two stud spaces apart for acoustic isolation.

I. Double-Layer Application:

1. Apply base layer with long dimension perpendicular to and centered on framing; apply face layer parallel to framing. Apply base layer parallel to framing where required by fire-resistive ratings.

2. Stagger sheets of each layer so that joints of each layer are 16-inches apart.

J. Isolation of Gypsum Board from Other Construction:

1. Provide perimeter relief where gypsum board abuts structural decks, ceilings, vertical structural elements, or window sections.

2. Finish gypsum board edge with corner bead.

3. Seal space between casing bead and structure with continuous sealant bead.

4. Seal around electrical boxes and conduit and pipe penetrations.

5. Seal at base of gypsum board sheets.

K. Acoustic Control Requirements for Sound Walls:

1. Leave a 1/8- to 1/4-inch space between gypsum board and adjacent construction to provide a space for acoustical sealant.

2. Seal airtight with acoustical sealant material specified in Section 07 92 19.

3. Seal penetrations through walls, or cuts in one face of walls, with a full bead of sealant at perimeter; this includes provisions for electrical outlet and switch boxes, pipes, ducts, and similar items.

4. Seal electrical boxes at the back with specified sheet sealant pad. Where wires enter the boxes, seal the openings airtight around the wires and knockout openings.

5. Install mild steel sleeves where required, fiberglass packing between sleeve or framing, penetrating item, and cover plates. Seal on both sides to render airtight.

6. Tolerance: 1/8-inch between wall boarding and sleeve, 3/8- to 5/8-inch between sleeve and service.

L. Installation of Fasteners:

1. Do not locate fasteners less than 3/8-inch from edges or ends of sheets. Do not locate fasteners less than one-inch from edges or ends in horizontal applications.

2. Fire-Rated Partitions: Install fasteners in accordance with the more restrictive of either IBC Chapter 7 or the Underwriters' Laboratories assemblies as denoted on partition schedule.

3. Non-Fire-Rated Partitions: Install fasteners in accordance with GA-216 and ASTM C840.

4. Fire-Rated Ceilings: Install fasteners in accordance with IBC Chapter 7.

5. Non-Fire-Rated Ceilings: Install fasteners spaced not more than 12-inches on center.

6. Install screws using powered screw guns with adjustable screw-depth control head. Drive shank perpendicular to gypsum board surface. Do not hammer screws.

7. Set fastener heads slightly below surface of gypsum board, but do not break or strip paper face around fastener.

8. Stagger fasteners opposite each other on adjacent ends and edges.

9. Omit fasteners at edges where metal edge trim will be installed.

M. Installation of Accessories:

1. Install corner trim at vertical and horizontal external corners and angles, and edge trim at junctions of gypsum board and other materials and at exposed edges.

2. Control Joints:

a. Ceilings: Maximum area for ceilings with perimeter relief shall be 2,500-sq. ft.; maximum area for ceilings without perimeter relief shall be 900-sq. ft. Do not exceed 50-feet between control joints in ceilings with perimeter relief; 30-feet between control joints in ceilings without perimeter relief.

b. Walls and Partitions: Maximum spacing between control joints shall not exceed 30-feet.

c. Control joint locations shall occur only where indicated on reviewed layout drawings.

3.03 TAPING AND FINISHING

A. Finish Levels: Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214 “Recommended Specification: Levels of Gypsum Board Finish”.

1. Level 0: In areas of temporary construction, no taping or accessories are required.

2. Level 1: Ceiling plenum areas and concealed areas. Provide higher level of finish as required to comply with fire-resistance ratings and acoustical ratings.

3. Level 2: Not used.

4. Level 3: Where scheduled, joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. The joint compound shall be smooth and free of tool marks and ridges.

5. Level 4: Where scheduled, joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. The joint compound shall be smooth and free of tool marks and ridges.

6. Level 5: Where scheduled, gypsum board surfaces shall be finished with a skim coat as specified.

B. Interior Gypsum Board Finishing:

1. Taping (Level 1):

a. Use taping or all-purpose compound.

b. Butter taping compound into inside corners and joints.

c. Center tape over joints and press down into fresh compound.

d. Remove excess compound. Tape joints of gypsum board above suspended ceilings.

2. First Coat (Level 2):

a. Use taping or all-purpose drying-type compound or setting-type joint compound.

b. Immediately after bedding tape, apply skim coat of compound over body of tape and allow to dry completely in accordance with manufacturer's instructions.

c. Apply the first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

3. Second Coat (Level 3):

a. Use all purpose or topping drying type joint compound.

b. After the first coat treatments is dried, apply second coat of compound over tape and trim, feathering compound 2-inches beyond edge of first coat.

4. Third Coat (Level 4):

a. Use all purpose or topping drying type joint compound.

b. After the second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2-inches beyond edge of second coat.

c. Allow the third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, ready for application of finish.

5. Skim Coat (Level 5):

a. Apply skim coat of all-purpose drying-type compound over exposed surfaces of gypsum board.

b. After skim coat has dried, touch-up and sand to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

C. Cut edges and openings around pipes and fixtures shall be caulked flush with sanitary sealant as specified in Section 07 92 00.

D. In the completed installation, gypsum board shall have plumb and straight surfaces with no waves or buckles. Joints, fastener heads, and trim flanges shall be invisible after finishing. Surfaces shall be uniformly smooth and ready for painting or other decoration.

E. Primer/Surfacer: Complete gypsum board surface to Level 4 before applying primer-surfacer. Machine-apply with airless sprayer in conformance with manufacturer's instructions to a wet film thickness of 15- to 20-mils. Allow it to dry overnight before painting.

3.04 PROTECTION OF FINISHED WORK

A. Maintain temperature and humidity conditions as required to protect the installation.

B. Protect completed gypsum board from damage or deterioration until final acceptance of the work.

END OF SECTION

SECTION 09 30 00

TILE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Floor tile.

2. Wall tile and base.

B. Related Sections:

1. Allowances are specified in Section 01 21 00.

2. Elastomeric liquid waterproofing is specified in Section 07 14 17.

3. Joint sealants are specified in Section 07 92 00.

4. Cementitious backing boards are specified in Section 09 28 13.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Furnish manufacturer's product data for each specified product.

C. Shop Drawings: Show tile patterns and locations and widths of expansion, contraction, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Verification: Furnish samples of the following items. Where products involve color and texture variations, furnish sets showing full range of variations expected.

1. Full-size units of each type of trim and accessory for each color required.

2. 12-inch-long samples of transition strips.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, and variety of tile from a single source with resources to provide products of consistent quality in appearance without delaying progress of the work.

B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

C. Installer's Qualifications: A minimum of 3-years' experience installing ceramic tile of the types specified, and a minimum of 5 installations of a magnitude like the work of this Section.

D. Floor tile shall have a minimum dynamic coefficient of friction (DCOF) of 0.42 determined in accordance with ANSI A137.1-2012.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with ANSI A137.1 for labeling sealed tile packages.

C. Prevent damage or contamination to materials by water, foreign matter, and other causes.

1.05 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at 50-deg. F. or more in tiled areas during installation and for 7-days after completion unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.06 EXTRA MATERIALS

A. Furnish additional tile for replacement and maintenance, at the rate of approximately 3-percent, to the nearest full carton, for each size, color, pattern, and type installed. Identify each carton as to contents.

PART 2 - PRODUCTS

2.01 TILE MATERIALS

A. Tile: To be selected under an allowance as specified in Section 01 21 00.

B. Trim Units: Provide trim units to match adjoining flat tile.

1. Size: Coordinate with sizes and coursing of adjoining flat tile.

2. Shapes: As indicated or required based on tile installation methods.

C. Aluminum Base: As indicated on the Drawings.

2.02 SETTING MATERIALS

A. Dry-Set Mortar: ANSI A118.1.

B. Latex Portland-Cement Mortar: ANSI A118.4.

1. Mortar shall be approved for use in thin-setting ceramic tile over elastomeric liquid waterproofing specified in Section 07 14 17.

2.03 GROUTING MATERIALS

A. Commercial Portland Cement Grout: ANSI A118.6, color as selected by the Architect.

B. Dry-Set Grout: ANSI A118.6, color as selected by the Architect.

C. Latex-Portland Cement Grout: ANSI A118.6, color as selected by the Architect.

D. Chemical-Resistant Epoxy Grout: ANSI A118.3, color as selected by the Architect.

E. Grout Schedule:

1. Wall Tile: Commercial portland cement, dry-set, or latex-portland cement.

2. Floor Tile: Epoxy.

2.04 MISCELLANEOUS MATERIALS

A. Tile and Carpet Transition Strips: Schluter Systems or approved equal, brushed chrome or satin aluminum finish, profiles and types indicated or required.

B. Tile Trim: Schluter Systems or approved equal, brushed stainless steel or satin aluminum, profiles indicated.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and areas where tile will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

3.02 PREPARATION

A. Blending: For tile exhibiting color variations within the range selected, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If tile is not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with referenced parts of ANSI 108 series of tile installation standards.

B. TCNA Installation Guidelines: Comply with TCNA "Handbook for Ceramic Tile Installation" referenced installation methods.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars or covers overlap tile.

E. Jointing Pattern: Lay tile in pattern indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise indicated.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

2. Prepare joints and apply sealants as specified in Section 07 92 00.

3.04 TILE INSTALLATION METHODS

A. Interior Floors:

1. Concrete Slabs: Thin set in accordance with ANSI A108.5 using TCNA Method F113.

2. Concrete Slabs with Waterproofing: Thin set over waterproofing membrane in accordance with ANSI A108.5 using TCNA Method F122. Waterproofing is specified in Section 07 14 17.

B. Interior Walls: Thin-set over cementitious backing board in accordance with ANSI A108.5 using TCNA Method W244.

C. Bathtub Walls: Thin set over cementitious backing board in accordance with ANSI A108.5 using TCNA Method W244 and B412, modified to include waterproofing under tile. Waterproofing is specified in Section 07 14 17.

D. Shower Walls with Shower Floor: Thin set over cementitious backing board in accordance with ANSI A108.5 using TCNA Method W244 and B412, modified to include waterproofing under tile. Waterproofing is specified in Section 07 14 17.

E. Expansion Joints: Comply with TCNA Method EJ171. Where joint locations are not indicated, the Contractor proposed joint locations shall be approved by the Architect.

3.05 CLEANING

A. Upon completion of placement and grouting, clean tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Do not use acid or acid cleaners to clean tile.

B. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

3.06 CURING

A. Damp cure tile installations, including portland cement grouts, for a minimum of 72-hours.

1. Cover with clean non-staining kraft paper.

2. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.07 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures tile is without damage or deterioration at time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

B. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

C. Apply sealer to portland cement grout installations in accordance with sealer manufacturer's recommendations. Apply to small test area and obtain Architect's approval before proceeding with application over large areas.

END OF SECTION

SECTION 09 60 13

ACOUSTICAL UNDERLAYMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Acoustical underlayment at gypsum cement underlayment.

2. Perimeter isolation barrier.

3. Installation adhesives and accessories.

B. Related Sections:

1. Gypsum cement underlayment is specified in Section 03 54 13.

2. Acoustical joint sealant is specified in Section 07 92 19.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's technical data with independent testing of actual floor assembly and laboratory results of sound control system. Provide report of tested STC level and IIC level.

1.03 QUALITY ASSURANCE

A. Installer: Minimum of 3-years' experience installing acoustical underlayment of the type required for this Project.

B. Manufacturer: Capable of providing job service during construction, approving installer, recommending appropriate application methods, and conducting a final inspection of the sound control system.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

PART 2 – GENERAL

2.01 MATERIALS

A. Acoustical Underlayment at Gypsum Cement Underlayment:

1. Approved Manufacturers: Maxxon Corporation “Acousti-Mat 1/4” or approved equal.

2. Material: Core of fused entangled mesh filaments, attached to a water resistant, non-woven fabric.

3. Thickness: 1/4-inch.

4. Flame Spread, ASTM E84: Class A.

B. Perimeter Isolation: Manufacturer’s recommended 1/4-inch-thick closed cell foam isolation strip.

C. Adhesive: As recommended by acoustical underlayment manufacturer.

PART 3 – GENERAL

3.01 SURFACE CONDITIONS

A. Subfloor shall be structurally sound, with deflection not more than L/600 of the span, including live and dead loads.

B. Subfloor shall be dry and free of debris.

3.02 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install perimeter isolation around the entire perimeter of the room including plumbing, electrical, cabinets and thresholds. Install 1/16-inch above the subfloor to prevent wrinkling at wall/subfloor intersection. Trim excess when finished flooring is complete.

C. Mastic-apply underlayment so that no bubbles or waves are visible. Ensure there is no greater than a 0.25-inch space between the wall and the acoustical underlayment. Wipe any excess mastic from the top side of seams. Roll with a 100-pound roller to remove air bubbles or adhesive inconsistencies.

D. No gaps or openings shall be allowed in the acoustical underlayment. Joints shall be taped or sealed to the satisfaction of the acoustical consultant. Furnish a letter from the manufacturer of the acoustical underlayment stating that the installation conforms to their standards and requirements.

E. Allow installation to cure for 24-hours.

3.03 PROTECTION

A. Protect installed products until Project completion.

END OF SECTION

C. Tests shall determine the change in weight of moisture-absorbing anhydrous calcium chloride and the results shall represent the amount of moisture transmitting out of the concrete slab area. The value shall be expressed in pounds and shall be equivalent to the weight of the water that is emitted from a 1,000-sq. ft. concrete slab area in a 24-hour period.

D. Unless more restrictive emission levels are required by finish flooring manufacturer, if calcium chloride testing reveals water vapor emission levels greater than 3-pounds per 1,000-sq. ft. for resilient flooring and 5-pounds per 1,000-sq. ft. for adhesively applied carpet, apply sealer in accordance with manufacturer's instructions. Alkalinity readings shall not exceed 9.0pH for adhesive applied flooring.

3.02 HUMIDITY TESTING

A. Where applied floor coverings have published relative humidity tolerances, perform humidity testing of concrete slabs in accordance with ASTM F2170.

B. Test results shall be expressed in percent and if the concrete is acceptable to receive floor coverings, coatings, toppings or vapor control sealers.

C. Concrete floors to be tested shall be at service temperature and interior room space above the floor slab shall be at service temperature and service humidity for at least 48 hours.

D. Test at a rate of three tests for areas up to 1,000-sq. ft. and one more test for each additional 1,000-sq. ft. of floor area.

E. Select test sites away from windows, protected from direct sunlight and 4-feet from exterior walls.

F. Drill a 2-inch-deep hole using an SDS hammer drill with a 5/8-inch bit. Blow the hole free of debris using compressed air and a vacuum. Insert the pre-measured sleeve in the hole and secure. Insert the RH probe, install sleeve cap and allow to remain for 72-hours. Allow holes to reach equilibrium for 72-hours. Remove the sleeve cap and connect the meter cable to the probe. Allow the probe to re-acclimate for 30 minutes.

G. Mark all test numbers and locations directly on the concrete surface. When readings are required later, apply the sleeve cap and return to test as required.

H. Unless more restrictive humidity levels are required by the finish flooring manufacturer, do not install flooring when humidity levels are greater than 75-percent RH.

3.03 APPLICATION OF VAPOR EMISSION CONTROL SYSTEM

A. Surface Preparation:

1. Concrete shall cure for 48-hours and be structurally sound, clean, free of dust, grease, oil, existing coatings, paint marks, carbonated layers, and other potential contaminants.

2. Concrete shall be heavily profiled in accordance with the International Concrete Surface Repair Institute to a Concrete Surface Profile (CSP) #4.

3. Profile edges, joints and cracks clean with a diamond crack chasing blade, removing fill.

4. Acid etching, sanding discs or grinding surfaces are not acceptable.

5. Vacuum the entire surface with an industrial unit. Do not use clean sweep agents.

B. Mixing: Mix in accordance with manufacturer’s instructions.

C. Application:

1. Pre-dampen concrete with clean water using an airless sprayer.

2. Allow surface to dry for 20-minutes and broom areas that puddle.

3. Pour product on concrete and scrub into surface with a nylon broom.

4. While wearing spike shoes re-apply product after 40-minutes.

5. Spread evenly over entire surface following rates recommended by manufacturer based on slab vapor emission levels. Apply multiple coats if required by slab vapor emission levels.

D. Crack and Joint Treatment: Cracks and joints less than 1/8-inch wide may be sealed during application. Re-seal cracks that remain exposed after application with additional product for greater crack bridging in accordance with manufacturer's instructions.

E. Cement Patching/Leveling:

1. Allow material to cure for a minimum of 12- to 24-hours before using a cement product to smooth uneven floor transitions. Cement shall be a minimum thickness of 1/8-inch to allow proper adhesive transfer.

2. Apply a non-porous primer to secure cement products.

END OF SECTION

SECTION 09 64 00

WOOD FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing:

1. Patching and repair of existing wood strip flooring.

2. Re-nailing existing wood strip flooring where required to eliminate squeaks.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: Specialized wood flooring firm with not less than 3-years successful experience in installation of types required.

B. General Standard: Comply with recommendations of "Hardwood Flooring Installation Manual" by National Oak Flooring Manufacturers' Association (NOFMA).

1.03 PROJECT CONDITIONS

A. Provide continuous ventilation during installation using as close to 100-percent outside air as possible.

PART 2 - PRODUCTS

2.01 WOOD STRIP/PLANK FLOORING

A. General: Provide wood strip flooring to match existing where required for patching and repair.

B. Species, Grade, and Cut: Species and cut to match existing.

C. Matching: Tongue and groove and end matched or as required to match existing.

D. Board Size: Match existing.

E. Thickness: Match existing.

F. Lengths: Manufacturer’s maximum random length strips.

G. Seasoning: Manufacture wood strip flooring from kiln-dried lumber with a maximum moisture content of 10-percent.

2.02 ACCESSORY MATERIALS

A. Felt Underlayment: ASTM D226, No. 15, asphalt-saturated felt.

B. Polyethylene Film: 6-mil thick.

C. Fasteners: As recommended by manufacturer, but not less than recommended by NOFMA in “Installation Manual”.

2.03 FINISHING MATERIALS

A. Stain: Penetrating type, nonfading wood stain, pigmented as required to match existing.

B. Wood Filler: Type compatible with stain or finish, pigmented if required to match existing.

C. Floor Sealer: Penetrating type, pliable, water-based, compatible with stain and finish.

D. Finish: Water-based polyurethane complying with environmental and flammability restrictions, compounded for multiple-coat application on wood floors.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates on which wood flooring will be installed and conditions under which work will be performed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION

A. Patch and repair existing wood flooring where indicated, required, or where directed by the Architect.

B. Install wood flooring using materials and techniques to match existing.

3.03 SANDING AND FINISHING

A. Machine sand installed unfinished flooring to remove offsets and non-level conditions, ridges, cups, and sanding machine marks which would be visually noticeable after finishing. Use 3 grades of sandpaper, ending with 00 grade. Vacuum clean and immediately apply finish. Do not permit traffic on floor after sanding and until finish is completed. Cover sanded floor with building paper to provide access for application of first finish coats.

B. Apply stain as required to match approved sample.

C. Apply wood filler with brush, followed by wiping across grain to work into pores and cracks.

D. Apply urethane finish, in accordance with manufacturer's instructions. Apply as many coats as required to build a dry film thickness of 1.0-mils.

3.04 PROTECTION

A. Protect completed wood flooring during remainder of construction period with heavy kraft paper or other suitable covering to prevent damage or deterioration. Do not use plastic sheet or film that could cause condensation.

B. Do not cover site-finished floors with kraft paper, rugs, or other material until the finish reaches full cure.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:

1. Resilient wall base.

2. Resilient flooring accessories.

B. Related Sections:

1. Resilient sheet flooring is specified in Section 09 65 16.

2. Resilient tile flooring is specified in Section 09 65 19.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Submit for each type of product specified.

C. Samples: Samples for verification purposes in manufacturer's standard sizes, but not less than 12-inches long, of each different color and pattern of product specified.

1.03 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

B. All materials shall comply with the requirements of the local Air Quality Management District (AQMD) governing the emission of Volatile Organic Compounds.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

C. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50- and 90-deg. F.

D. Move products into spaces where they will be installed at least 48 hours prior to installation.

1.05 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70-deg. F. in spaces to receive products specified in this Section for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation. After this period, maintain a temperature of not less than 55-deg. F.

B. Do not install products until they are at the same temperature as that of the space where they are to be installed.

C. Close spaces to traffic during installation of products specified in this Section.

D. Provide continuous ventilation during installation using as close to 100-percent outside air as possible.

1.06 SEQUENCING AND SCHEDULING

A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

1.07 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage, and identified with labels clearly describing contents.

1 Furnish not less than 10-linear feet for each 500-linear feet or fraction thereof of each different type and color of resilient wall base installed.

PART 2 - PRODUCTS

2.01 RESILIENT WALL BASE

A. Rubber Wall Base: Johnsonite, Burke, Flexco, VPI, Roppe or approved equal complying with ASTM F1861, Type TS or TP.

1. Style: Cove with top-set toe for use with resilient flooring.

2. Height: 4-inches.

3. Lengths: Coils in lengths standard with manufacturer but not less than 100-feet.

4. Color: As selected by the Architect.

2.02 RESILIENT ACCESSORIES

A. Provide rubber cap for cove vinyl sheet flooring and reducer strips for resilient flooring where required.

B. Profile and Dimensions: As indicated.

C. Color: As selected by the Architect from manufacturer's standards.

2.03 INSTALLATION ACCESSORIES

A. Adhesives: Provide VOC-compliant type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.

PART 3 – EXECUTION

3.01 PREPARATION

A. Comply with manufacturer's installation specifications for preparing substrates indicated to receive products indicated.

B. Use trowelable leveling and patching compounds per manufacturers directions to fill cracks, holes, and depressions in substrates.

C. Broom or vacuum clean substrates to be covered immediately before installing products specified in this Section. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

3.02 INSTALLATION

A. Install products specified in this Section using methods indicated according to manufacturer's installation directions.

B. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

C. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.03 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.

2. Damp-mop resilient accessories to remove black marks and soil.

B. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish the date of Substantial Completion in each area of Project. Clean products using methods recommended by manufacturer.

END OF SECTION

SECTION 09 65 16

RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes resilient sheet floor coverings.

B. Related Sections:

1. Water vapor emission and humidity testing and control systems are specified in Section 09 61 43.

2. Resilient base and accessories are specified in Section 09 65 13.

3. Resilient tile flooring is specified in Section 09 65 19.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Submit for each type of product specified.

C. Shop Drawings: Show location of seams and edge strips. Indicate location of columns, doorways, enclosing partitions, built-in cabinets, and locations where cutouts are required in flooring.

D. Samples:

1. For verification purposes in form of 6-inch by 9-inch sections of each different color and pattern of resilient sheet floor covering product specified, showing full range of variations expected in these characteristics.

2. Sample of coved base outside corner showing techniques to be used in forming outside corners. Modify as directed by the Architect until corner sample is approved.

E. Maintenance data for resilient sheet floor coverings.

F. Warranty.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage Installer that is certified by floor covering manufacturer as competent in the technique for heat-welding seams.

B. Fire Performance Characteristics: Provide resilient sheet floor coverings with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by Underwriters Laboratories, Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45-watts per sq. cm or more per NFPA 253 (ASTM E648).

2. Smoke Density: Less than 450 per NFPA 258 (ASTM E662).

1.04 REGULATORY REQUIREMENTS

A. Slip Resistant Surfaces: Conform to the more restrictive provisions of Title III of the Americans with Disabilities Act or International Building Code (IBC).

1. Resilient flooring shall have a dynamic coefficient of friction (DCOF) of at least 0.42 per ANSI A137.1-2012.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver resilient sheet floor coverings and installation accessories to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

C. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50- and 90-deg. F.

D. Move resilient sheet floor coverings and installation accessories into spaces where they will be installed at least 48-hours in advance of installation.

1.06 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70-deg. F. in spaces to receive resilient sheet floor coverings for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation. After this period, maintain a temperature of not less than 55-deg. F. and not more than 95-deg. F. unless otherwise acceptable to the floor covering manufacturer.

B. Do not install resilient sheet floor coverings until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic while installing resilient sheet floor covering.

D. Provide continuous ventilation during installation using as close to 100-percent outside air as possible.

1.07 SEQUENCING AND SCHEDULING

A. Install resilient sheet floor coverings and accessories after other finishing operations, including painting, have been completed.

B. Do not install resilient sheet floor coverings over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as specified in Section 09 61 43.

1.08 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

1. Furnish not less than 5-percent, in roll form of each different composition, wearing surface, color, and pattern of resilient sheet floor covering installed.

PART 2 - PRODUCTS

2.01 RESILIENT SHEET FLOOR COVERINGS

A. Manufacturer, Pattern and Color: As indicated in the Floor Finish Legend on the Drawings.

2.02 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by floor covering manufacturer for applications indicated.

C. Adhesives: Provide VOC-compliant type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient flooring for conditions of installation.

D. Rod for Heat-Welding Seams: Product of floor covering manufacturer in color as selected by the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive.

2. Finishes of subfloors comply with tolerances and other requirements specified in Section 03 30 00 for slabs receiving resilient flooring.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

4. Slab moisture and alkalinity levels shall comply with the requirements specified in Section 09 61 43.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's installation specifications to prepare substrates indicated to receive resilient sheet floor coverings.

B. Use trowelable leveling and patching compounds per floor covering manufacturer's direction to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by resilient sheet floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply according to manufacturer's directions.

3.03 INSTALLATION

A. Comply with resilient sheet floor covering manufacturer's installation instructions and other requirements indicated that are applicable to each type of floor covering installation included in Project.

B. Lay out resilient sheet floor coverings to comply with the following requirements:

1. Maintain uniformity of resilient sheet floor covering direction.

2. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 6-inches away from parallel joints in flooring substrates.

3. Match edges of resilient floor coverings for color shading and pattern at seams.

4. Avoid cross seams.

C. Scribe, cut, and fit resilient sheet floor coverings to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including cabinets, pipes, outlets, edgings, thresholds, and nosings.

D. Extend resilient sheet floor coverings into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

F. Adhere resilient sheet floor coverings to flooring substrates by method approved by floor covering manufacturer.

1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

2. Comply with floor covering manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

G. Heat-weld seams in resilient sheet floor coverings where this seaming method is indicated or required for the selected flooring. Prepare, weld, and finish seams to produce a surface flush with adjoining sheets.

H. Integral Flash Cove Base: Where indicated, cove resilient sheet floor coverings up vertical surfaces to form integral base of height indicated over cove support strip with top edge butted against and covered by cap molding. Form inside and outside corners in accordance with manufacturer’s instructions and to match approved sample.

I. Hand roll resilient sheet floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. On walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing resilient sheet floor coverings:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by floor covering manufacturers.

2. Sweep or vacuum the floor thoroughly.

3. Do not wash the floor until after period recommended by floor covering manufacturer.

4. Damp-mop floor to remove black marks and soil.

B. For linoleum sheet flooring, expose installed flooring to either natural or artificial light to allow "drying room yellowing" on installed flooring to disappear prior to initiating temporary protection procedures.

C. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by floor covering manufacturer.

1. Cover resilient sheet floor coverings with undyed, untreated building paper until inspection for Acceptance of Work.

2. Do not move heavy and sharp objects directly over resilient sheet floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Clean resilient sheet flooring not more than 4-days prior to dates scheduled for inspections intended to establish date of Acceptance of Work in each area of Project. Clean resilient sheet floor coverings by method recommended by manufacturer.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:

1. Resilient tile flooring.

B. Related Sections:

1. Water vapor emission and humidity testing and control systems are specified in Section 09 61 43.

2. Resilient base and accessories are specified in Section 09 65 13.

3. Resilient sheet flooring is specified in Section 09 65 15.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Submit for each type of product specified. Include certification by tile manufacturer that products supplied for tile installation comply with local regulations controlling use of volatile organic compounds (VOC's).

C. Samples: For verification purposes in full-size tiles of each different color and pattern of resilient floor tile specified, showing full range of variations expected in these characteristics.

D. Maintenance data to include in Operating and Maintenance Manual.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.

B. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

C. Materials shall comply with the requirements of the local Air Quality Management District (AQMD) governing the emission of Volatile Organic Compounds.

1.04 REGULATORY REQUIREMENTS

A. Slip Resistant Surfaces: Conform to the more restrictive provisions of Title III of the Americans with Disabilities Act.

1. Resilient flooring shall have a minimum dynamic coefficient of friction (DCOF) of 0.42 determined in accordance with ANSI A137.1-2012.

1.05 PRODUCCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver resilient tile flooring and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

C. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50-deg. F. and 90-deg. F.

D. Store flooring on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48-hours in advance of installation.

1.06 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70-deg. F. in spaces to receive tiles for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation. After this period, maintain a temperature of not less than 55-deg. F.

B. Do not install tiles until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during tile installation.

D. Provide continuous ventilation during installation using as close to 100-percent outside air as possible.

1.07 SEQUENCING AND SCHEDULING

A. Install tiles and accessories after other finishing operations, including painting, have been completed.

B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.08 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

1. Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern, and size of resilient floor tile installed.

PART 2 - PRODUCTS

2.01 RESILIENT TILE FLOORING

A. Manufacturer, Pattern and Color: As indicated in the Floor Finish Legend on the Drawings.

2.02 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Non-staining VOC-compliant type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

C. Adhesives: Provide VOC-compliant type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where installation of tiles will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.

2. Finishes of subfloors comply with tolerances and other requirements specified in Section 03 30 00 for slabs receiving resilient flooring.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

4. Slab moisture levels shall comply with the requirements specified in Section 09 61 43.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.

B. Use trowelable leveling and patching compounds per tile manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

F. Test concrete slabs to receive resilient tile flooring for moisture levels. Verify moisture levels comply with flooring manufacturer’s requirements.

3.03 INSTALLATION

A. Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Terminate flooring at least 1/4-inch away from any perimeter walls or fixed partitions.

F. Extend tiles into toe spaces, door reveals, closets, and similar openings.

G. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

H. Within 30-minutes after installation of flooring, roll and cross roll the entire floor with a 100-pound sectional floor roller.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing tile installation:

1. Remove visible adhesive and other surface blemishes using a cleaner recommended by tile manufacturers.

2. Sweep or vacuum the floor thoroughly.

3. Do not wash the floor until recommended by resilient floor tile manufacturer.

4. Damp-mop tile to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended by tile manufacturer.

1. Cover tiles with undyed, untreated building paper until inspection for Acceptance of Work.

2. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean tiles not more than 4 days prior to dates scheduled for final acceptance. Clean tiles using method recommended by manufacturer.

END OF SECTION

SECTION 09 81 00

ACOUSTIC INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing acoustic insulation.

B. Related Sections:

1. Engineered insulation system is specified in Section 07 21 14.

2. Sprayed thermal insulation is specified in Section 07 21 19.

3. Firestopping insulation is specified in Section 07 84 00.

4. Acoustical joint sealants are specified in Section 07 92 19.

1.02 SUBMITTALS

A. General: As specified in Section 01 33 00.

B. Product Data: Manufacturer's specifications for each type of insulation required.

1.03 QUALITY ASSURANCE

A. Fire Ratings: Comply with fire-resistance and flammability ratings specified.

B. Fiberglass-based acoustic insulation shall be Greenguard Gold Certificated.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Protect insulation from physical damage and from becoming wet or soiled. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.05 INDOOR AIR QUALITY

A. Protect ducts and HVAC system from loose insulation particulates.

B. Provide temporary ventilation of building areas where building insulation is being installed.

PART 2 - PRODUCTS

2.01 ACOUSTIC BATT/BLANKET INSULATION

A. Formaldehyde-Free Unfaced Mineral/Glass Fiber Blanket/Batt Acoustical Insulation: Acoustical insulation produced by combining glass fibers with formaldehyde-free thermosetting resins to comply with ASTM C665, Type I.

1. Surface Burning Characteristics: Maximum flame-spread and smoke developed values of 25 and 50 when tested in accordance with ASTM E84.

2. Approved Manufacturers: Johns Manville "Formaldehyde-Free Sound Control Fiber Glass Batts", CertainTeed "NoiseReducer Sound Attenuation and Acoustical Ceiling Batts", Owens Corning "PINK Next Gen Sound Attenuation Batts (SAB)" or approved equal.

3. Thickness: As indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions for installation conditions.

B. Do not install insulation until building is sufficiently enclosed or protected against absorption of moisture by the insulation, and do not install insulation unless supporting framing and construction is in a thoroughly dry condition.

C. Install snugly between framing members with ends snugly fitted between units and against adjacent construction.

D. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.

E. Where door and window frames occur in framing, cut additional strips of insulation and hand-pack as required to fill voids in and around such frames.

3.02 PROTECTION

A. Protect installed insulation from harmful exposures and from physical damage.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for painting and finishing of interior and exterior exposed items and surfaces.

1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatments specified in other Sections.

2. Work includes painting exposed pipes and ducts, hangers, exposed steel and iron, and primed metal surfaces of Mechanical and Electrical equipment, and general sheet metal work, except as otherwise indicated or specified.

3. Work includes painting hardware specified as primed (USP or 600).

4. Work includes sanding shop-primed surfaces and applying specified primer and finish coats.

5. "Paint" means coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

B. Surfaces Not to Be Painted:

1. Pre-finished items, including but not limited to acoustic materials, casework, and finished mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.

2. Concealed surfaces such as walls or ceilings in concealed areas and inaccessible areas, furred areas, pipe spaces, and duct shafts.

3. Finished metal surfaces such as anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials, exterior aluminum entrances, storefronts, and windows.

4. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor, and fan shafts.

5. Existing plaster walls indicated to be cleaned and sealed. Coordinate with Section 01 35 92.

C. Following categories of work are included under other Sections:

1. Shop priming ferrous metal items including structural steel, metal fabrications, hollow metal work and similar items. The work of this Section includes sanding and applying specified primer on all shop-primed surfaces exposed to view in the completed work.

2. Shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

3. Piping identification is specified in Division 22 and 23.

D. Do not paint over code-required labels, equipment identification, performance rating, name, or nomenclature plates.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Certification: Furnish certification by the paint manufacturer that products supplied comply with local regulations controlling the use of volatile organic compounds (VOCs). Include VOC content of all paint products.

C. Samples: Furnish samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until the required sheen, color, and texture is achieved.

2. Furnish samples on the following substrates for review of color and texture only:

a. Painted Wood: Two 12-inch square samples of each color and material on hardboard.

b. Stained or Natural Wood: Two 4-inch x 8-inch samples of natural and stained wood finish on actual wood samples.

D. Product Data: Specified paint systems are those of Benjamin Moore, Dunn Edwards, Kelly Moore, Sherwin Williams, and Vista. If other paint manufacturers are proposed and accepted by the Architect, furnish product comparison charts showing that proposed paint systems are equal to the specified materials in number of coats, type of paint, and sheen.

1.03 QUALITY ASSURANCE

A. VOC content of interior paints shall not exceed 5 g/L.

B. Applicators Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent.

C. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use thinners approved by paint manufacturer and use within recommended limits.

D. Coordination of Work: Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates. Upon request, furnish information or characteristics of finish materials to be used.

E. Requirements of Regulatory Agencies: Comply with applicable rules and regulations of governing agencies for air quality control.

1. Comply with current applicable regulations of the local air quality district and the Environmental Protection Agency (EPA).

2. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to start of painting.

F. Field Samples: On interior and exterior wall surfaces provide full-coat finish samples on at least 100-sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work. Approved samples will be used as a standard for the Project.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials to job site in original, new, and unopened packages and containers bearing manufacturer's name, batch number, color, and directions.

C. Store materials in tightly covered containers. Maintain containers in a clean condition, free of foreign materials and residue.

D. Keep the storage area neat and orderly. Remove oily rags and waste daily. Ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.05 JOB CONDITIONS

A. Apply water-base paints when temperature of surfaces to be painted and surrounding air temperatures are between 50-deg. F. and 90-deg. F., unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45-deg. F. and 90-deg. F., unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in rain, fog or mist, when relative humidity exceeds 85-percent, or when temperature is less than 5-deg. F. above dew point, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

D. Provide adequate ventilation during interior painting using as close to 100-percent outside air as possible.

1.06 EXTRA MATERIALS

A. In addition to materials for completion of the work, furnish 5-gallons of additional materials for each type and color of opaque paint used.

B. Furnish extra materials from same production lots or color runs used in the work. Furnish in containers factory sealed and labeled. Identify each container with Project name and type of material.

C. Deliver materials and an inventory list just prior to Substantial Completion and store where directed by Owner.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Benjamin Moore, Dunn Edwards, Kelly Moore, Sherwin Williams, Vista or approved equal.

2.02 MATERIALS

A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application.

B. Material Quality: Provide the best quality grade of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable. Each product within any one paint system shall be from the same manufacturer.

2.03 COLORS AND SHEENS

A. Paint Colors and Sheens: Match samples furnished by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting is to be applied. The surfaces receiving paint shall be thoroughly dry before paint is applied.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect prior to applying barrier coats.

2. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning.

3. Start of painting will be construed as the applicator's acceptance of surfaces and conditions within an area.

3.02 PROTECTION

A. Protection: Protect work of other Sections against damage by painting and finishing work. Correct damage by cleaning, repairing, or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

2. Remove or protect hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting. Following completion of painting, reinstall removed items.

3. At completion of work of other Sections, touch-up and restore damaged or defaced painted surfaces.

3.03 SURFACE PREPARATION

A. Concrete and Masonry:

1. Prepare surfaces to be painted by removing surface contaminates.

a. Remove efflorescence with stiff bristle brush, wire brushing, wiping, sandblasting or acid washing and rinsing. Allow to dry.

b. Remove chalk, dust, dirt, asphalt, tar, or excessive mortar by scraping or wire brushing.

c. Remove rust, grease or oil by solvent cleaning or sandblasting.

d. Treat concrete surfaces which are highly glazed or where traces of form release agents are present with a preparation of one-part concentrated muriatic acid, 4-parts water and one-part detergent or as recommended by parting compound manufacturer. Remove acid with water. Allow to dry.

e. Remove stains on concrete resulting from weathering or corroded metals, with a solution of 2-oz. sodium methasilicate in one-gallon water. Wet stained areas with water before application of solution. Allow to dry.

B. Plaster:

1. Clean surfaces free from grit, loose plaster, and surface irregularities.

2. Determine alkalinity and moisture content by performing appropriate tests. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's literature or where pH exceeds 10.

C. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dry.

2. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

3. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

D. Ferrous Metal: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of The Society for Protective Coatings (SSPC).

1. Blast surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC specification SSPC-SP 10.

2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

3. Sand shop-applied prime coats to a smooth surface, ready to receive specified primer and finish coats.

E. Galvanized Metals:

1. Clean galvanized metal with an appropriate metal prep and passivator remover.

2. Perform the following test to ensure passivator removal:

a. With a 5-percent copper sulfate solution, place a swab or droplets on the prepared area. If the copper sulfate causes the galvanized coating to blacken, passivator has been removed and the surface is ready for paint application.

b. If the copper sulfate has no effect on the galvanized coating, continue with metal prep solution, prepared in accordance with SSPC-SP 16 “Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals” or use a scotch pad to abrade it, being careful not to remove the galvanizing.

3. Document the process and successful passivator removal with photographs.

4. Prepare weathered galvanized metals that have developed a layer of white rust by wire brushing or scrubbing with a stiff brush or abrasive pad to remove the white rust.

F. Gypsum Board: Clean surfaces of dust, dirt, grease, oil and other foreign matter and dust clean.

G. Existing Surfaces to be Repainted: Thoroughly clean and de-gloss surfaces to be repainted by sanding or other means prior to painting. Patched and bare areas shall be shop-primed with same alkyd primer as specified for new work.

3.04 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and strain material before using.

D. Use thinners approved by the paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.05 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Provide finish coats compatible with prime coats.

2. The number of coats required is the same regardless of the application method. Do not apply following coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where required to produce a smooth even surface.

3. Apply additional coats when undercoats, stains or other conditions show through final coat, until paint film is of uniform finish, color and appearance. Edges, corners, crevices, welds, and exposed fasteners shall receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture.

5. Paint surfaces behind permanently-fixed equipment or furniture with prime coat before final installation of equipment.

6. Paint visible surfaces of ducts where visible through registers or grilles with a flat, non-specular black paint.

7. Paint the back sides of access panels, and removable or hinged covers to match exposed surfaces.

8. Finish doors on top, bottom, and side edges same as faces. Where openings into rooms have different finishes, finish door edges as directed by the Architect.

9. Omit primer on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation.

1. Allow sufficient time between successive coatings to permit proper drying.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

1. Brushes: Use brushes best suited for the material applied.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.

E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces. Finish to match adjoining wall or ceiling surfaces.

1. Mechanical items to be painted include, but are not limited to, piping, hangers, and supports; heat exchangers; tanks; ductwork; insulation; supports; motors and mechanical equipment; air grilles and diffusers; and accessory items.

2. Electrical items to be painted include, but are not limited to conduit and fittings, panels, and switchgear.

F. Block Filler: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled flush, free of pinholes. Provide multiple coats if required.

G. Prime Coats: Before applying finish coats, apply a prime coat. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas to assure a finish coat with no burn-through or other defects.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

I. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.06 CLEANING

A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans, and rags at end of each workday.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by washing and scraping; do not scratch or damage finished surfaces.

3.07 EXTERIOR PAINT SCHEDULE

		BENJAMIN MOORE	DUNN-EDWARDS	KELLY-MOORE	SHERWIN WILLIAMS	VISTA	MPI CATEGORY
A. Ferrous Metal, 100% Acrylic Semigloss							
	First Coat	Ultra Spec UP04	BRPR00 Series Bloc-Rust	6646 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	9600 Protec Metal Primer	107
	Second Coat	Ultra Spec 449	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Selmigloss	7000 Acriglo Semi Gloss	11

	Third Coat	Ultra Spec 449	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
B. Galvanized and Zinc Alloy Metal, 100% Acrylic Semigloss							
	Pretreatment	Etch	ME-01 Krud Kutter Metal Clean & Etch	Krud Kutter Metal Clean & Etch	B71Y1 DTM Wash Primer	Krud Kutter Metal Etch	
	First Coat	Fresh Start Acrylic Primer #023	ULGM00 Ultrashield Galvanized Metal Primer	6646 DTM Acrylic Primer/Finish	ProCryl B66-310Primer	4800 Metal Pro Primer	134
	Second Coat	Ultra Spec 449	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
	Third Coat	Ultra Spec 449	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
C. Plaster, Concrete, 100% Acrylic Flat							
	First Coat	Fresh Start Acrylic Primer N023	ESPR00 Eff-Stop Premium Primer	247 Acry-Shield	A24W300 Loxon Primer	4600 Uniprime II	3
	Second and Third Coats	Ultra Spec N447	SSHL10 Spartashield Flat	1200 Premium Professional Flat	A-100 A6 Flat	2200 Coverall Flat	10
D. Concrete Block, 100% Acrylic Flat							
	First Coat	Ultra Spec 0571	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 Prep Rite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Ultra Spec 447	SSHL10 Spartashield Flat	1200 Premium Professional Flat	A-100 A6 Flat	2200 Coverall Flat	10
E. Wood, 100% Acrylic Semigloss							
	First Coat	Fresh Start Acrylic Primer N023	EZPR00 EZ-Prime Premium	255 Acry-Shield	B42W81 Exterior Latex Primer	4200 Terminator II	6
	Second and Third Coats	Ultra Spec 449	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
F. Wood, Acrylic Semi-Transparent Stain							
	First and Second Coats	Arborcoat N638	ZIN-OK 700 Series Okon Weather Pro	1285 Acry-Shield	A15T5 WoodScapes	Monopole Aquaseal Stain	156

3.08 INTERIOR PAINT SCHEDULE

	BENJAMIN MOORE	DUNN-EDWARDS	KELLY-MOORE	SHERWIN WILLIAMS	VISTA	MPI CATEGORY
A. Wood, 100% Acrylic Low Odor/Zero VOC Semigloss						
First Coat	Fresh Start 0217	UGSL00 Ultragrip Select	973 Acry-Plex	ProMar 200 Zero B28-200 Primer	5001 V-Pro Primer	46
Second and Third Coats	Ultra Spec N539	SZRO50 Sparta-Zero Semi-Gloss	1050 Premium Professional SG	ProMar 200 Zero B31-2600 Semi-Gloss	5400 V-Pro Semi Gloss	---
B. Wood, Clear Satin Urethane Finish						

	First Coat	Lenmar Sealer 1PR.100	Defthane Polyurethane Gloss	Old Masters Masters Armor Satin	A68V91 Wood Classics WB Polyurethane Varnish GL	Defthane Polyurethane Gloss	---
	Second and Third Coats	Lenmar Aqua Plastic 1WB.1427	Defthane Polyurethane Satin	Old Masters Masters Armor Satin	A68 Wood Classics WB Polyurethane Varnish SG	Defthane Polyurethane Satin	128
C. Wood, Stain and Satin Urethane Finish							
	First Coat	Lenmar 1 WB Wiping Stain	Old Masters Wiping Stain	Old Masters Wiping Stain	Minwax 250 Oil Stain	Old Masters Wiping Stain	90
	Second Coat	Lenmar Sealer 1PR.100	Old Masters Water-Based Sanding Sealer	Old Masters Water-Based Sanding Sealer	A68V91 Wood Classics WB Polyurethane Varnish GL	Old Masters Water-Based Sanding Sealer	---
	Third and Fourth Coats	Lenmar Aqua Plastic 1WB.1427	Old Masters Water-Based Polyurethane Satin	Old Masters Masters Armor Satin	A68 Wood Classics WB Polyurethane Varnish SG	Old Masters Water-Based Polyurethane Satin	128
D. Concrete and Plaster, Acrylic Low Odor/Zero VOC Flat							
	First Coat	Ultra Spec N534	Ultra-Grip Select UGSL00	971 Acry-Plex	ProMar 200 Zero B28-2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Ultra Spec N536	SZRO10 Sparta-Zero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
E. Concrete and Plaster, 100% Acrylic Low Odor/Zero VOC Low Sheen/Eggshell							
	First Coat	Ultra Spec N534	Ultra-Grip Select UGSL00	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Ultra Spec N538	SZRO30 Sparta-Zero Eggshell	1010 Premium Professional Eggshell	ProMar 200 Zero B20w2651 Eggshell	5300 V-Pro Eggshell	145
F. Concrete and Plaster, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Ultra Spec N534	SBSL00 Smooth Blocfil Select	971 Acry-Plex	ProMar 200 Zero B28-2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Ultra Spec N540	SZRO50 Sparta-Zero Semigloss	1050 Premium Professional Semi-Gloss	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
G. Concrete Block, Acrylic Low Odor/Zero VOC Flat							
	First Coat	Ultra Spec 0571	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 PrepRite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Ultra Spec N536	SZRO10 Sparta-Zero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
H. Concrete Block, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Ultra Spec 0571	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 PrepRite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Ultra Spec N540	SZRO50 Sparta-Zero Semi-Gloss	1050 Premium Professional Semi-Gloss	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
I. Gypsum Board, Acrylic Low Odor/Zero VOC Flat							

	First Coat	Ultra Spec N534	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5100 V-Pro Flat	149
	Second and Third Coats	Ultra Spec N536	SZRO10 Sparta-Zero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
J. Gypsum Board, 100% Acrylic Low Odor/Zero VOC Low Sheen/Eggshell							
	First Coat	Ultra Spec N534	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	149
	Second and Third Coats	Ultra Spec N538	SZRO30 Sparta-Zero Eggshell	1010 Premium Professional Eggshell	ProMar 200 Zero B28-2651 Eggshell	5300 V-Pro Eggshell	145
K. Gypsum Board, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Ultra Spec N534	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	149
	Second and Third Coats	Ultra Spec N540	SZRO50 Sparta-Zero Semi-Gloss	1050 Premium Professional Semi-Gloss	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
L. Ferrous Metal, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Ultra Spec HP04	BRPR00 Series Bloc-Rust	6646 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	9600 Protec Metal Primer	107
	Second and Third Coats	Ultra Spec N540	SZRO50 Sparta-Zero Semi-Gloss	1050 Premium Professional SG	Pro Industrial Acrylic B66w651 Semi-Gloss	7000 Acriglo Semi Gloss	147
M. Non-Ferrous Metal, 100% Acrylic Low Odor/Zero VOC Semigloss							
	Pretreatment	Etch	ME-01 Krud Kutter Metal Etch & Clean	Krud Kutter Metal Etch	B71Y1 Wash Primer	Krud Kutter Metal Etch	
	First Coat	Ultra Spec HP04	ULGM00 Ultrashield Galvanized Metal Primer	6646 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	4800 Metal Pro Primer	107
	Second and Third Coats	Ultra Spec N540	SZRO50 Sparta-Zero Semi-Gloss	1050 Premium Professional SG	HP Acrylic B66w651 Semi-Gloss	7000 Acriglo Semi Gloss	147

END OF SECTION

SECTION 11 31 00

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing residential appliances.

B. Related Sections:

1. Residential casework is specified in Section 12 35 30.

2. Plumbing is specified in Division 22.

3. HVAC is specified in Division 23.

4. Electrical is specified in Division 26.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications and installation instructions for each type of appliance. Include operating and maintenance instructions for each item.

1.03 QUALITY ASSURANCE

A. Certification Labels: Furnish residential appliances with UL labels.

B. Refrigerators, dishwashers, and clothes washers shall be Energy Star rated.

C. Uniformity: Provide products of the same manufacturer for each type of residential appliance required. Where specified, provide residential appliances by a single manufacturer for the entire Project.

1.04 REGULATORY REQUIREMENTS

A. Accessibility: Conform to the more restrictive provisions of Title III of the American with Disabilities Act or the IBC.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver appliances to Project site in manufacturer's undamaged protective containers, after spaces to receive them have been fully enclosed.

C. Store appliances in a dry protected area in manufacturer's protective containers, away from construction traffic and debris areas, until installation.

PART 2 - PRODUCTS

2.01 RESIDENTIAL APPLIANCES

A. To be selected by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install appliances in accordance with manufacturer's instructions and recommendations.

B. Securely anchor built-in appliances to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper operation and rough openings are completely concealed.

3.02 ADJUST AND CLEAN

A. Test each appliance to verify proper operation. Make necessary adjustments.

B. Remove packing material from appliances and leave in clean condition, ready for operation.

END OF SECTION

SECTION 12 35 30

RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes residential casework.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

2. Residential appliances are specified in Section 11 31 00.

3. Solid surfacing countertops are specified in Section 12 36 61.

4. Plumbing fixtures are specified in Division 22.

5. Electrical is specified in Division 26.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product data for each casework and hardware type specified. Include country of casework manufacture.

C. Shop drawings for casework showing location and size, accessories, materials, finishes, and filler panels. Include fully dimensioned plans, elevations, and anchorage details to countertop and walls.

D. Samples: 12-inch square finish samples verifying initial selections. Furnish multiple samples if required to show complete range of color and variations.

1.03 QUALITY ASSURANCE

A. Casework: Comply with National Kitchen Cabinet Association (NKCA) testing requirements and HUD Formaldehyde Emissions Test 24CF3280 and German Standard DIN58861 Part 1B for stain resistance.

B. Accessibility Requirements: Comply with IBC and ADA requirements.

C. Single-Source Responsibility: Obtain casework from one source of a single manufacturer.

1.04 ENVIRONMENTAL QUALITY ASSURANCE

A. Cabinets, shelving, and countertop substrates shall be free of added formaldehyde or fully sealed on all six sides by a laminate or a primer or sealer with a VOC content of 150 g/L or less.

B. Cabinets shall be left in a well-ventilated warehouse for a minimum of 72-hours prior to delivery to the Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver casework as factory-assembled units, packaged individually.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Comply with casework manufacturer's written requirements for temperature and humidity conditions during storage and installation. Do not install casework until these conditions have been attained and stabilized.

B. Field Measurements: Verify casework dimensions by field measurements. Verify kitchen casework can be installed in compliance with the original design and referenced standards.

PART 2 - PRODUCTS

2.01 CASEWORK MATERIALS AND FABRICATION

A. Approved Manufacturer: As approved by the Architect.

B. Cabinet Box:

1. Frameless European style design with full access design and overlay styling.

2. Panel materials are MDF or commercial grade plywood with white laminated water-resistant surfaces. Side panels, rails and base bottoms are 5/8-inch thick. Shelves and wall tops/bottoms are 5/8-inch or 1/4-inch thick. Wall and tall back panels are 1/2-inch thick. Base backs (excluding sink bases) are 1/8-inch thick. Panel and rail components shall be joined with engineered dowels and/or glue.

3. Shelves shall be full depth, adjustable in 32 mm or 64 mm vertical spacing.

4. Exposed sides shall match the door finish.

5. Base and tall cabinets shall have a 4-inch toe kick. Kitchen cabinets shall have a matching toe kick board.

6. Refrigerator spaces shall have 5/8-inch-thick side panels finished on all sides.

7. Lower cabinets in residential units shall have open backs exposed to gypsum board construction.

8. Provide ADA compliant removable base cabinets where indicated.

9. Cabinet boxes shall be square within +/- 2 mm per 36-inches diagonally. Interior gaps shall be less than 1 mm.

C. Doors, Drawer Fronts and Frames:

1. Doors and drawer fronts shall be constructed from 5/8-inch or 3/4-inch MDF with a melamine white backer.

2. Fascia shall be square, without mill marks or damage or defects.

3. Doors shall be mounted on 35 mm six-way adjustable clip-on style concealed metal hinges.

4. Warping measuring vertically or diagonally top to bottom shall be less than 1 mm per 24-inches.

5. Door and Drawer Style: Flush.

6. Facing Material and Finish: Thermofoil in color as selected by the Architect.

D. Drawer Construction:

1. Drawer depth shall be 21.3-inches on standard kitchen depth cabinets and 18.3-inches on standard bath depth cabinets.

2. Drawer bottoms and backs shall be constructed of laminated white 1/2-inch or 5/8-inch furniture grade plywood.

3. Base top drawers shall be mounted to allow at least 4-1/8-inches of unencumbered vertical interior clearance; base lower drawers shall be mounted to allow at least 8-inches of 10-inches of unencumbered clearance, based on cabinet.

4. Metal slides shall have a geared side cam system for adjustments of up to 4 mm.

E. Moldings:

1. Horizontal moldings shall be shipped a minimum of 8-feet long. Runs shorter than 84-inches shall not have a seam. Seams shall be joined diagonally and placed in the least visible location.

2. Moldings shall be free of loose knots or mill marks and match cabinet color.

F. Fillers and Trim:

1. Provide fillers to fit wall openings, clear knobs and handles, clear door casings and appliance handles.

2. Fillers installed against walls shall be 3-inches wide or less. Minimum filler shall be 3/4-inches wide.

3. Fillers installed in wall to corner or corner to corner installations shall be a minimum of 2-inches or 5-inches depending on the wall-to-wall dimensions, handle clearance requirements and appliance handles.

G. Hardware:

1. Drawer Guides: High quality epoxy coated steel, side mounted guides, self-adjusting in mounting brackets. Built-in stop, soft-closing, and stay-closed feature with a 100-pound rated load capacity.

2. Hinges: European style frameless overlay metal concealed hinges with a 120-deg. opening with soft-closing feature. Doors over 36-inches high shall have 3 hinges per door panel.

3. Door and Drawer Pulls: To be selected by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install casework with no variations in flushness of adjoining surfaces using concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.

B. Install casework without distortion so that doors and drawers fit openings properly and are aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of 1/8-inch in 8-feet.

D. Fasten unit of casework to adjacent unit and into structural support members of wall construction with #10 sheet metal or wood screws with washer head or washer.

3.02 ADJUSTING AND CLEANING

A. Adjust hardware to center doors and drawers in openings and lubricate to provide unencumbered operation.

B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 12 36 61

SOLID SURFACING COUNTERTOPS

PART 1 — GENERAL

1.01 DESCRIPTION

A. This Section includes solid surfacing countertops, sinks, and backsplashes.

B. Related Sections:

1. Joint sealants are specified in Section 07 92 00.

2. Residential casework is specified in Section 12 35 30.

1.02 SYSTEM DESCRIPTION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.03 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Include product data for each product.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.

1. Shop drawings shall comply with North America Architectural Woodwork Standards (NAAWS 4.0) Section 01 – Submittals.

2. Apply a Woodwork Institute Certified Compliance Label to the first page of the shop drawings.

3. Show full-size details, edge details, thermoforming requirements, and attachments.

4. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

5. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in solid surface.

D. Samples:

1. For each type of product indicated.

a. Furnish minimum 6-inch by 6-inch sample in specified gloss.

b. Cut sample and seam together for representation of inconspicuous seam.

c. Indicate full range of color and pattern variation.

2. Approved samples will be retained as a standard for work.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.

G. NSF/ANSI Standards: Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.

H. Maintenance Data: Furnish manufacturer's care and maintenance data, including repair and cleaning instructions.

I. Warranty.

1.04 QUALITY ASSURANCE

A. Fabricator: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer: Arrange for installation by a firm that can demonstrate successful experience in installing solid surfacing countertops similar in type and quantity to those required for this Project.

C. Fire Test Response Characteristics: Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame Spread Index: 25 or less.

2. Smoke Developed Index: 450 or less.

D. Job Mock-up:

1. Prior to fabrication, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.

2. Mock-up shall be of a typical countertop as directed by the Architect.

3. Build the mock-up to comply with the Contract Documents and install in a location as directed by the Architect.

4. Notify the Architect two weeks in advance of the date of when the mock-up will be delivered.

5. Should mock-up not be approved, re-fabricate and reinstall until approval is secured. Remove rejected units from project site.

6. After approval, the mock-up may become a part of the Project.

7. This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Do not deliver components to the Project site until areas are ready for installation.

C. Store components indoors prior to installation.

D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 WARRANTY

A. Warrant solid surfacing countertops to be free from defects in materials and workmanship for a period of 10 years from date of Substantial Completion. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1.08 MAINTENANCE

A. Provide maintenance requirements as specified by the manufacturer.

PART 2 — PRODUCTS

2.01 MATERIALS

A. Grade: NAAWS 4.0 Section 11, Premium Grade.

B. Solid Surface: A filled cast polymeric resin panel meeting the requirements of NAAWS 4.0.

1. Manufacturer, Pattern, Color, and Finish: To be selected by the Architect.

C. Backsplash and Sidesplash: Butt joint, height indicated.

D. Front Edge: Self-edge unless otherwise indicated.

E. Countertop Thickness: 1/2-inch unless otherwise indicated.

F. Edge Thickness: Minimum 1-1/2-inch.

2.02 ACCESSORIES

A. Joint Adhesive: VOC compliant type as recommended by manufacturer to create inconspicuous, nonporous joints.

B. Sealant: Manufacturer’s standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Conductive Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

D. Insulating Felt Tape: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.03 FABRICATION

A. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.

B. Form joints between components with precision-machined and glued joints with material supplier's hard seaming material. Reinforce with strip of solid polymer material, 2-inches wide.

C. Provide factory cutouts for plumbing fittings and bath accessories as indicated.

D. Rout and finish component edges with clean, sharp returns. Rout cutouts, radii and contours to template. Smooth edges. Repair or reject defective and inaccurate work.

E. Bottom of countertop build up and sub top shall be surface flush within 1/16-inch, free of glue residue, and sanded or filled smooth with edges eased at knee spaces or cantilevers.

PART 3 — EXECUTION

3.01 EXAMINATION

A. Site Verification:

1. Verify that substrates supporting solid surfaces are plumb, level, and flat to within 1/16-inch in 10-feet and that necessary supports and blocking are in place.

2. Base cabinets shall be securely fixed to adjoining units and back wall.

B. Inspect finished surfaces for damage. Do not install until damage materials have been repaired in an acceptable manner or replaced.

3.02 PREPARATION

A. Protect finished surfaces against scratches. Apply masking where required. Guard against grit, dust, and damage from other work.

3.03 INSTALLATION

A. Install countertops level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

1. Provide products in the largest pieces available.

2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Exposed joints/seams shall not be allowed.

3. Reinforce field joints with solid surface strips extending a minimum of 1-inch on either side of the seam with the strip being the same thickness as the top.

4. Cut and finish component edges with clean, sharp returns.

5. Rout radii and contours to template.

6. Anchor securely to base cabinets or other supports.

7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.

8. Carefully dress joints smoothly, remove surface scratches and clean entire surface.

9. Install countertops with no more than 1/8-inch sag, bow or other variation from a straight line.

10. Scribe countertops to abutting vertical surfaces with uniform 1/8-inch-wide joints filled with color-matched sealant.

11. Cantilevers with or without a sub-top shall not exceed 12-inches for ¾-inch or 6-inches for ½-inch thick material.

B. Splashes:

1. Install applied splashes using manufacturer's standard color-matched silicone sealant.

2. Adhere applied splashes to countertops using manufacturer's standard color-matched silicone sealant.

3.03 REPAIR

A. Repair or replace damaged work which cannot be repaired to Architect's satisfaction.

3.04 CLEANING AND PROTECTION

A. Keep components clean during installation.

B. Remove adhesives, sealants and other stains.

END OF SECTION

SECTION 14 24 00

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies hydraulic elevator.

B. Related Sections:

1. Section 01 50 00 – Temporary Facilities and Controls: Protection of floor openings and personnel barriers; temporary power and lighting.

2. Section 03 30 00 - Cast-In-Place Concrete: Elevator pit, and elevator machine foundation.

3. Section 05 50 00 - Metal Fabrications: Divider beams, and supports for entrances, rails and hoisting beam at top of elevator machine room.

4. Section 05 51 33 – Metal Ladders: Pit ladder.

5. Division 07 Sections: Waterproofing of elevator pit.

6. Section 14 42 99 – Vertical Platform Lifts.

7. Division 21 Section: Fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine room.

8. Division 23 Sections: Ventilation and temperature control of elevator equipment areas.

9. Division 26 Sections:

a. Main disconnects for each elevator.

b. Electrical power for elevator installation and testing.

c. Disconnecting device to elevator equipment prior to activation of sprinkler system.

d. The installation of dedicated GFCI receptacles in the pit and overhead (with Machine room-less).

e. Lighting in controller area, machine area and pit.

f. Wiring for telephone service to controller.

1.02 REFERENCES

A. Comply with applicable building codes and elevator codes at the project site, including but not limited to the following:

1. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.

2. ADAAG, Americans with Disabilities Act Accessibility Guidelines.

3. ANSI/NFPA 70, National Electrical Code.

4. ANSI/NFPA 80, Fire Doors and Windows.

5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

6. ANSI/UL 10B, Fire Tests of Door Assemblies.

7. IBC.

8. All other local applicable codes.

1.03 SYSTEM DESCRIPTION

A. Equipment Description: Holeless hydraulic elevators with remote machine room.

B. Type: Holeless hydraulic elevators, dual jack, front openings as indicated.

C. Number of Stops: Five.

D. Openings: Front and rear.

E. Rise: As indicated.

F. Rated Capacity: 3,500-pounds.

G. Rated Speed: 150-fpm.

H. Clear Car Inside: 6’-8” wide x 5’-6-1/2” deep.

I. Entrance Type: One speed, center opening, 3’-6” x 7’-0”

J. Cab Height: 7’-4”.

K. Main Power Supply: Refer to Electrical Drawings, 3 Phase, with a separate equipment grounding conductor.

L. Lighting Power Supply: 120 Volts, 1 Phase, 15 Amp, 60 Hz.

M. Stopping Accuracy: ±1/4-inch under any loading condition or direction of travel.

N. Door Opening Time for 7ft. painted hoistway and car doors: 3.5 seconds – Single Slide 42-inch door.

O. Operation: Simplex.

P. Provide microprocessor-based control system with utilizes on-board diagnostics for servicing, troubleshooting, and adjusting without requiring the use of an outside service tool. If an on-board diagnostic system is not provided, a handheld service tool (or laptop), owner's license, operation manual, and tool instructions must be provided in addition to the control system.

Q. Car Operating Features

1. Full Collective Operation.

2. Single Speed Fan.

3. On/Off Light Switch.

4. Solid State Starting

5. Remote elevator monitoring REM® ready.

6. Car-Stall Protection.

7. Firefighters' Service Phase I and Phase II.

8. Top of Car Inspection.

9. Emergency Communications: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)" On activation, system dials preprogrammed number of monitoring station and identifies elevator location, to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

10. Car Secure Access.

11. Battery-Powered Lowering: When power fails, cars are lowered to the lowest floor, cycle their doors, and shut down with the doors closed. System includes rechargeable battery and automatic recharging system.

R. Door Control Features:

1. Closed Loop Door Operator: Closed loop, microprocessor-based door operator system. The door operator will facilitate smooth operation under varying environmental influences such as, temperature, wind, friction, and component variation. The processor will monitor the door's actual position and velocity compared to its desired position and velocity. If variations are detected in the profile the command will be automatically corrected. The Closed Loop Door Operator control system shall not require machine room door control equipment.

2. Door noise not to exceed 58dBA.

3. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.

4. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.

5. Primary door protection shall consist of a two-dimensional, multi-beam array projecting across the car door opening. Under normal operation and for any door position, the system shall detect as a blockage an opaque object that is equal to or greater than 1.3-inches in diameter when inserted between the car doors at vertical positions from within 1-inch above the sill to 71-inches above the sill. Under degraded conditions (one or more blocked or failed beams), the primary protection shall detect opaque objects that are equal to or greater than 4-inches in diameter for the same vertical coverage. If the system performance is degraded to the point that the 4-inch object cannot be detected, the system shall keep the doors open or permit closing only under nudging force conditions.

6. The secondary protection shall have an anti-nuisance feature which will ignore detection in the secondary zone after continual detection occurs for a significant time period in the secondary zone without corresponding detection in the primary protection zone, i.e. a person/object is in the entryway but does not enter. Normal secondary protection shall be re-enabled whenever a detection occurs in the primary zone.

7. The reaction time of the door detector sub-system shall not exceed 60 milliseconds when both primary and secondary protection capabilities are active; nor 40 milliseconds when the secondary protection is disabled.

8. Door nudging operation to occur if doors are prevented from closing for an adjustable period.

1.05 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:

1. Signal and operating fixtures, operating panels, and indicators.

2. Cab design, dimensions, and layout.

3. Hoistway-door and frame details.

4. Electrical characteristics and connection requirements.

5. Expected heat dissipation of elevator equipment in machine room (BTU).

C. Shop Drawings: Submit approval layout drawings. Include the following:

1. Car, guide rails, buffers, and other components in hoistway.

2. Maximum rail bracket spacing.

3. Maximum loads imposed on guide rails requiring load transfer to building structure.

4. Loads on hoisting beams.

5. Clearances and travel of car.

6. Clear inside hoistway and pit dimensions.

7. Location and sizes of access doors, hoistway entrances and frames.

D. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.06 QUALITY ASSURANCE

A. Manufacturer: Provide elevators manufactured by a firm with a minimum of 10 years' experience in fabrication of elevators equivalent to those specified. The elevator manufacturer shall be ISO9002 certified.

B. Installer: Elevators shall be installed by the manufacturer.

C. Regulatory Requirements: Elevator system design and installation shall comply with the latest versions of: ASME A17.1 and CBC.

1. Elevators shall be designed in response to Americans with Disabilities Act Accessibility Guidelines (ADAAG).

D. Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01 61 00.

B. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the Contractor shall be responsible to provide a proper and suitable storage area on or off the premises.

1.08 MAINTENANCE SERVICE

A. Maintenance service consisting of regular examinations, adjustments and lubrication of the elevator equipment shall be provided for a period of 12-months after the elevator has been turned over for the Owner's use. This service shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days and shall include emergency 24-hour callback service. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Thyssenkrup "Endura"; no substitutions to fit hoistway dimensions indicated.

2.02 EQUIPMENT: MACHINE ROOM COMPONENTS

A. The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. These functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a muffler, low-pressure switch and a shut-off valve.

B. The entire hydraulic system with hydraulic-fluid storage tank, power component and valves shall be in a remote machine room.

C. A microprocessor-based controller shall be provided, including the necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.

D. The controller shall be located together with the hydraulic system in the remote machine room.

E. A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

F. Pressure switch.

G. Low-oil control.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

A. Plungers and Cylinders: Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

1. A sealed PVC cylinder protection system shall be installed. The system shall provide a means to monitor the space between the PVC sleeve and cylinder wall and evacuate unwanted fluids, to prevent such fluids from remaining in contact with the cylinder.

B. Car Guide Rails: Steel rails with brackets and fasteners.

C. Polyurethane type buffers.

D. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.

E. Hoistway Entrances:

1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of 14-gauge sheet steel.

2. Sills: Extruded aluminum.

3. Doors: Entrance doors shall be of hollow metal construction with vertical internal channel reinforcements.

4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour.

5. Entrance Finish: Stainless steel, No. 4 finish.

6. Entrance Marking Plates: Entrance jambs shall be marked with 4-inch x 4-inch plates having raised floor markings with Braille adjacent. Markings shall be provided on both sides of the entrance.

7. Sight Guards: Black sight guards will be furnished with any metal finish door. Powder paint matching sight guards will be furnished with powder paint doors.

2.04 EQUIPMENT: CAR COMPONENTS

A. Cab: Steel shell cab with applied panels finished as selected by the Architect.

B. Car Front Finish: Satin stainless steel.

C. Car Door Finish: Satin stainless steel.

D. Ceiling Type: As selected by the Architect.

E. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of a building power failure.

F. Fan: One-speed 120 VAC fan mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 requirement. The fan shall be rubber mounted to prevent the transmission of structural vibration and shall include a baffle to diffuse audible noise. A switch shall be provided in the car operating panel to control the fan.

G. Handrail: Provide on the side walls of the car enclosure. Handrails shall be 1-1/2-inch diameter round stainless-steel bar with satin finish.

H. Threshold: Extruded aluminum.

I. Emergency Exit Contact: Provide an electrical contact on the car-top exit.

J. Guides: Car roller type at the top and bottom.

K. Platform: Metal.

L. LED ceiling lights and the fan shall automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes the hall button.

M. Certificate Frame: Satin stainless steel.

N. Protective pad hooks and quilted fire-retardant protective pads. Pad Buttons will be provided with non-suspended ceiling.

O. Floor: LVT as selected by the Interior Designer.

2.05 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, card reader, and message indicators for elevator operation. The car operating panel shall have a satin stainless-steel finish.

1. Car operating panel shall have satin stainless steel finish and contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. Buttons shall be a minimum 3/4-inch in size and shall be raised 1/8-inch above the surrounding surface. Control buttons shall be illuminated and have square shoulders. Control buttons shall be designated by a 5/8-inch minimum raised characters and symbols immediately left of the control button. Contracted Grade 2 Braille shall be located immediately below the numeral, character, or symbol. The raised characters and symbols shall be white on a black background.

2. The car operating panel shall be equipped with the following features:

a. Raised markings and Braille shall be provided to the left-hand side of each push button.

b. Car position indicator at the top; integral to the car operating panel.

c. Door open and door close buttons.

d. Light key-switch.

e. Fan key-switch.

f. Inspection key-switch.

g. Elevator data plate marked with elevator capacity and car number.

h. Illuminated alarm button with raised markings.

i. In car stop switch.

j. Firefighter’s hat.

k. Firefighter’s Phase II key-switch.

l. Call cancel button.

j. Emergency communications system as specified.

k. Firefighter’s Phase II emergency in-car operating instructions.

l. Landing passing signal. A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.

B. Car Position Indicator: A digital LED car position indicator shall be integral to the car operating panel.

C. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a polycarbonate face plate that is shatterproof and impact resistant.

1. Hall Call Buttons: Buttons shall be a minimum of 3/4-inch in size and shall be raised 1/8-inch above the surrounding surface. Hall call buttons shall be internally illuminated with a white light over the entire surface.

D. Car and Lantern Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install elevator components in accordance with manufacturer's instructions.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. Fasten hoistway frames to fixing angles mounted in the hoistway.

D. Lubricate operating system components in accordance with manufacturer's recommendations.

E. Perform final adjustments and service prior to Substantial Completion.

3.03 DEMONSTRATION

A. Make a final check of each elevator operation with the Architect and Owner's representative present prior to turning each elevator over for use. Verify that control systems and operating devices are functioning properly.

END OF SECTION

SECTION 14 42 00

PLATFORM LIFTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes vertical platform lift.

B. Related Sections:

1. Hydraulic elevators are specified in Section 14 21 00.

2. Electrical is specified in Division 26.

1.02 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Product Data: Manufacturer's specifications and catalog cuts or renderings of items exposed to view.

C. Shop Drawings: Complete shop and erection drawings, to scale, showing the following:

1. Layouts: Plan and section of lift shaft and machinery space. Indicate required clearances around equipment.

2. Data: Indicate on layouts or on separate data sheets static and dynamic loads imposed on structure. Include all electrical loads.

D. Samples: Materials and finishes exposed to public view; 6-inch x 6-inch panels or 12-inch lengths as applicable.

E. Certificates: Inspection certificates of governing authorities.

F. Maintenance and operating manuals.

G. Warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years' experience in design and fabrication of platform lifts of the type required for this Project.

B. Installer: Manufacturer or installer approved by manufacturer, with documented experience in the installation of accessible lifts.

C. Requirements of Regulatory Agencies: Comply with applicable provisions of following and as specified.

1. International Electric Code.

2. ASME A18.1.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Section 01 61 00.

B. Deliver materials in the manufacturer's original, unopened, protective packaging.

C. Store materials in dry, protected area. Keep free of corrosion or other damage.

D. Protect equipment and exposed finishes during transportation and erection against damage and stains.

1.05 PROJECT CONDITIONS

A. Coordinate installation work that relates to the work of this Section for the placing of required backing and support.

1.06 WARRANTY

A. Warrant platform lift to be free from defects in materials and workmanship for a period of 2 years from the date of Substantial Completion. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Garaventa "Genesis Opal" or approved equal.

2.02 UNENCLOSED VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 pounds.

B. Mast Height: As required.

C. Platform Size: 37-1/4-inches wide x 53-7/8-inch long.

D. Platform Configuration: Straight Through.

E. Landing Openings: Gate shall be self-closing type with mechanical interlock.

1. Gate Width: 36-inch.

2. Gate Height: 42-1/8-inch.

3. Platform Gate: Travels with platform and opens at lower landing.

4. Upper Landing Gate: Installed at upper landing.

F. Power Gate Operators:

1. Automatically opens the gate when platform arrives at a landing. Will open at landing by pressing call button or gently pulling the gate.

2. ADA compliant and obstruction sensitive.

3. Low voltage, 24 VDC with concealed wiring.

G. Lift Components:

1. Machine Tower: Custom aluminum extrusion.

2. Base Frame: Structural steel.

3. Platform Side Wall Panels: 16-auge galvanized steel sheet.

4. Platform Access Ramp: 12-gauge galvanized steel plates; slip resistant surfaces.

a. Ramp: Automatic folding type.

5. Side Guard Panels: 42-1/8-inch high mounted on platform.

H. Base Mounting at Lower Landing: Floor mounted with automatic folding ramp.

I. Lead Screw Drive:

1. Motor: 2 HP.

2. Motor Drive Type: ACME screw.

3. Electrical: 120 VAC on a dedicated 20 amp circuit.

4. Speed: 10-ft. per minute at full load.

J. Safety Features:

1. Doors and gates equipped with interlocks and internal closers.

2. 16-gauge galvanized steel platform side walls 42-1/8-inch high.

3. Continuous pressure directional control switches.

4. Illuminated and audible emergency stop switch.

5. Full length grab rail on platform side wall panel.

K. Controls:

1. Keyless controls (no key required for call stations and platform controls.

2. Directional Controls: Continuous pressure switches.

3. Control Voltage: 24 VDC.

L. Finish: Silver Moon powder coated aluminum extrusions and 16-gauge galvanized steel panels and steel posts with Silver Moon powder coat finish.

PART 3 - EXECUTION

DIVISION 21

FIRE SUPPRESSION

END OF INDEX

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SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SCOPE

A. The Contract Documents do not specify exact installation means and methods. Installation means and methods are the responsibility of the Contractor. No instruction or statement made on the Contract Documents shall be interpreted to shift this responsibility away from the Contractor.

1.2 DEFINITIONS

A. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unconditioned shelters.

B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in duct shafts, and in utility chases.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and mechanical yards.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include finished spaces and mechanical equipment rooms.

E. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unconditioned spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and utility tunnels.

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and project conditions, and pay all costs necessary to perform the work.

1.4 FIRE SPRINKLER CONTRACTOR

A. The Fire Sprinkler Subcontractor shall have a minimum of 2 years of documented experience on projects of similar scope and complexity.

B. The Fire Sprinkler Subcontractor shall hold a current contracting license in the State of Arizona as a fire sprinkler contractor.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules, and regulations.

B. Fees and Permits: Pay all connection, installation, use, disposal, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01 specifications.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01 specifications.

1.6 DRAWINGS AND SPECIFICATIONS

A. Refer to Division 01 specifications for additional information on submittals and shop drawings.

B. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be Contract Documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

C. Plans and calculations must be approved by the Authority Having Jurisdiction before they are submitted to the Engineer for review.

D. Product Information Sheets: Provide project-specific manufacturer's literature which includes the information required by the Product Data paragraph of the applicable specification section. Where product information sheets show multiple models or options, clearly mark the model and options to be provided.

1. Identify options requiring selection by the Engineer.

E. Assembly: Assemble all required submittal information for each specification section and submit in PDF format.

1. Assemble PDF submittals in one PDF file for each division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.

2. Partial submittals and submittals that are not project specific will be returned without review.

F. Identification and Information:

1. Name the PDF file with the project name, division number and sequential submittal number (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2).

2. Provide a cover sheet at the front of each submittal with the following information:

a. Project name.

b. Date.

c. Name of Engineer.

d. Name of Contractor.

e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

a. Name of supplier.

b. Name of manufacturer.

c. Number and title of appropriate specification section.

d. Drawing number and detail references, as appropriate.

e. Other necessary identification.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Furnished by Others: This project is to provide a complete and functional system. Where material or labor is indicated in the submittal to be provided by Contractor, Subcontractor, or Owner clearly indicated who is providing those items and include information to indicate proper coordination.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current Material Safety Data Sheets (MSDS) for all hazardous materials that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of 1 week prior to the delivery of any hazardous materials to the site.

2. Maintain a second complete set at the project location, readily accessible by both the Owner’s personnel and the Contractor’s personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information (RFI):

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.

2. A properly-prepared RFI shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specifications in need of clarification and the nature of the clarification requested.

a. Drawings shall be identified by drawing number and location on the drawing sheet.

b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based on the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the Contract Documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner, who may deduct an equal amount from the monies due the Contractor.

1.10 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings.

1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Include all equipment, and underground and overhead piping.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Include dimensions both horizontally and vertically to permanent points of reference, accurate within 6 inches. Include descriptors such as "below slab," "above ceiling," etc.

c. Record data daily or as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.

2. Mark the As-Built Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of As-Built Drawings.

3. Mark the As-Built Drawings with erasable, red colored pencil, or in a digital PDF format using an editor program such as Bluebeam, Adobe Acrobat Professional, or similar. Use other colors to distinguish between changes for different categories of the work at the same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

5. Update the As-Built Drawings weekly or daily as appropriate for the project size.

B. Format: Identify and date each As-Built Drawing; include the designation "PROJECT AS-BUILT DRAWING" in a prominent location.

1. Organize newly-prepared As-Built Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification, as follows:

a. Project name.

b. Date.

c. Designation “PROJECT AS-BUILT DRAWINGS.”

d. Name of Engineer.

e. Name of Contractor.

3. Remove or obscure the Engineer’s seal and signature from As-Built Drawings.

1.11 RECORD DRAWINGS

A. Record Drawings: Immediately before inspection for Certificate of Substantial Completion, submit final marked-up As-Built Drawings to the Architect for review. When authorized, prepare a full set of corrected Record Drawings of the Contract Drawings, as follows:

1. Utilize the same digital data software program, version, and operating system as for the original Contract Drawings to incorporate changes and additional information previously marked on As-Built Drawings. Delete, redraw, and add details and notations where applicable.

2. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

3. Refer instances of uncertainty to the Architect for resolution.

4. Format: Provide Digital Record Drawing files in both DWG and PDF format. Organize Record Drawing information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

B. Record Drawings Submittal:

1. Submit Digital Record Drawings and three sets of Record Drawing plots.

2. Plot each drawing file, whether or not changes and additional information were recorded.

1.12 QUALITY ASSURANCE

A. Welding:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

1.13 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment Operation and Maintenance Manual for all equipment supplied under Division 21.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to Substantial Completion for review and comment.

2. Submit the final version of the manual not more than 4 weeks after Substantial Completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF Electronic Files: Assemble each manual into a single master directory with subdirectories for the individual PDF files for each system and piece of equipment. Provide a table of contents file with hyperlinks to each of the individual PDF files within the subdirectories. Submit on digital media acceptable to the Engineer.

a. Name each directory, subdirectory, and document file with applicable item name.

b. Enable reviewer comments on draft submittals.

2. Paper Copies: Assemble paper copies in 3-ring binders. Separate and order systems and equipment within each binder. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab. Enclose title pages and directories in clear plastic sleeves.

D. Provide Operation and Maintenance Manuals for all systems, subsystems, and equipment that require operation and regular maintenance, or have replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturer's maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this section, include operation and maintenance data required in individual specification sections.

F. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match the manual's table of contents. For each product, list the name, address, and telephone number of the installer or supplier and maintenance service agent, and cross-reference the specification section number and title in the Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on the Contract Documents.

2. Approved submittals.

3. Include the following if not shown on approved submittals:

a. Product name and model number. Use designations for products indicated on the Contract Documents.

b. Manufacturer’s name.

c. Equipment identification with serial number of each component.

d. Equipment function.

e. Operating characteristics.

f. Limiting conditions.

g. Performance curves.

h. Engineering data and tests.

H. Operating Procedures: Include the following information, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures, including precautions against improper use.

10. Operating logs.

I. Wiring Diagrams: Diagram of factory-installed wiring, including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Manufacturer’s Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

L. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

M. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

N. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

O. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

P. Licenses: Include copies of any licenses with requirements, including inspection and renewal dates.

Q. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1.14 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. The Contractor must staff the project with sufficient skilled workmen, including a fully-qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of the same type or classification by the same manufacturer.

1.15 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 specifications for description of material and equipment for prior approvals and substitutions.

1.16 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. Refer to Division 01 specifications for additional requirements.

B. Cooperative work includes:

1. General supervision and responsibility for proper location, rough-in, and size of work related to Division 21 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts, and anchors bolts for work under sections in Division 21.

1.17 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and legally disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused piping, controls, and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining fire protection services to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Architect and Owner.

D. Disconnect, demolish, and remove fire sprinkler systems, equipment, and components that are indicated to be removed.

1. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with the same or compatible piping material. Patch insulation, as required, to match adjacent areas.

2. Piping to be Abandoned in Place: Drain piping and cap or plug piping with the same or compatible piping material.

3. Equipment to be Removed: Disconnect and cap services and remove equipment.

4. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment fixtures operational.

5. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment, and deliver to Owner.

E. Continuity of Services in Existing Building: The Contractor shall permanently reroute existing fire sprinkler services or provide temporary connection as required to maintain service to areas in the building which are to remain in service.

F. Rerouting and Relocation of Existing Fire Protection Equipment and Services in Existing Building:

1. General: The Contractor shall reroute/relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.

2. Existing Piping: Where applicable, existing material may be reused in its original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are modified, reused, or are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.18 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment, and such facilities shall be kept clear of materials or equipment. Refer to Division 01 specifications for additional requirements.

B. Furnish and maintain, from the beginning to the completion of all work, all lawful and necessary security, guards, railings, fences, canopies, lights, fire protection, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.19 WARRANTY

A. Provide a written warranty that all material, equipment, installation, and workmanship for all sections under Division 21 are to be free from defects of material and workmanship for 2 years from date of final acceptance as outlined in Division 01 specifications. Equipment warranties shall be a minimum of 2 years from date of Substantial Completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period.

1.20 ELECTRICAL WORK

A. Electrical wiring, including power wiring and control wiring, except as otherwise specified under Division 21, all raceways, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in Division 26 and Division 28 of the specifications.

B. All loose starters and control devices, except as otherwise specified under Division 21, are to be furnished and installed under Division 26.

C. Contractor shall be responsible for the checking and testing of all controls and the interlocks for a complete and satisfactory operating system.

D. Before ordering any motors and equipment, verify the available voltage and phase for all motors with the Division 26 Contractor.

E. Submit a complete list of all motors prior to final closeout of the project indicating the location, horsepower, voltage, phase, and amperage draw of each motor.

F. All field wiring and equipment must conform to the applicable Division 26 specification sections.

PART 2 - PRODUCTS

2.1 MACHINERY DRIVES

A. Unless otherwise specified in Division 21 equipment sections, use V-belts designed for 150% of capacity for all belt drives. For multiple belt drives, use matched sets, so marked at the factory.

B. On drives with not more than two belts, provide adjustable pitch motor sheaves with the midpoint of the adjustment range equal to that required to achieve the specified fan capacity.

C. On motors with drives with more than two belts, furnish non-adjustable sheaves providing the specified fan capacity.

2.2 MACHINERY ACCESSORIES

A. Guards: Provide totally-enclosed OSHA-type belt guards for all rotating equipment. Design guards to be readily removable for access to belt drives.

2.3 EQUIPMENT DESIGN AND INSTALLATION

A. Design all equipment in accordance with the latest edition of ASME, AGA, UL, and other applicable technical standards as follows:

1. Pressure Vessels: ASME Code constructed and stamped.

2. Electric Appliances: UL labeled.

3. Fire Protection Equipment: UL approved and labeled.

2.4 GROUT

A. Description: ASTM C1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.

2. Design Mix: 5,000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Submit one copy of PDF submittals via email, project website, or other electronic media.

3.2 RECORD DOCUMENTS

A. Recording: Post changes and modifications to the project Record Documents as they occur; do not wait until the end of the project.

B. Maintenance of Record Documents and Samples: Store Record Documents in the field office, apart from the Contract Documents used for construction. Do not use project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project Record Documents for the Engineer's reference during normal working hours. As-Built Drawings will be reviewed by the Architect, Owner, and Engineer at each pay request review.

C. Submit As-Built Drawings to the Architect for approval before completion of Record Drawings.

D. Secure the Record Drawings in a red-enameled steel cabinet adjacent to the fire sprinkler riser at completion of the project.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Prepare operation and maintenance manuals as directed.

B. Submit a preliminary electronic copy of the operation and maintenance manual to the Engineer for review.

C. Make any corrections noted from the Engineer's review upon receipt of comments and resubmit as required.

D. Submit the final, corrected operation and maintenance manual in both paper and electronic format to the Architect.

3.4 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and many offsets, bends, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine the best sequence and installation methods, exact locations, routes, and building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in a manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.5 CUTTING AND PATCHING

A. Cut work and patch per Division 01 specifications as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary design and installation of steel to support pipes between structural steel unless shown on the structural drawings.

3.6 CLOSING IN OF UNFINISHED WORK

A. Cover no work until inspected, tested, and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested, and approved, restore all work to original proper condition.

3.7 EXCAVATION AND BACKFILL

A. Provide not less than 4 inches of granular material as pipe bedding. Grade and compact trench bedding accurately prior to laying pipe in trench to provide uniform bearing and support for each section of pipe along its entire length. Dig “bell” holes after the trench bottom has been graded and compacted. Granular material shall be pea gravel or sand.

B. Provide backfilling and compaction to the required density in accordance with provisions of these specifications and under the direction of the Architect.

C. Provide not less than 4 inches of granular material, the same as piping bedding, all around pipe. Make the first 2 feet of fill in 6-inch layers, each thoroughly compacted as directed, with no puddling, and free from rocks, large clods of earth, leaves, branches, and debris. Compact the rest of the backfill as directed, using in the backfill no rocks larger than 4 inches in diameter, and using no rock in the top 12 inches.

3.8 ACCESSIBILITY

A. Install valves, gauges, control devices, or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the Contract Drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Fire Sprinkler Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves, and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified in Division 08 specifications.

C. Refer to architectural drawings for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to locate valves, etc., with others to avoid unnecessary duplication of access doors.

3.9 FLASHINGS

A. Flash and counterflash all piping penetrating exterior walls. Refer to architectural drawings for detailing of pipe penetrations through walls.

3.10 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, valves, sensors, etc., shall be installed in strict conformance with the manufacturer’s recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

C. Install equipment and piping level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

D. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment and piping to allow right-of-way for piping installed at required slope.

F. Do not install any equipment in an application not recommended by the manufacturer.

G. Provide metal box with red-enamel paint or powder coating mounted on wall adjacent to fire sprinkler riser. Provide a minimum of two spare sprinklers of each type installed within the building and wrenches required to replace sprinklers.

H. Provide metal box with red-enamel paint or powder coating mounted on wall adjacent to fire sprinkler riser(s). Provide a complete set of fire suppression Record Drawing plots in cabinet.

3.11 EQUIPMENT SUPPORTS

A. Erection of Metal Supports and Anchorages:

1. Refer to Division 05 specifications for structural steel.

2. Design, cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment. Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

3. Field Welding: Comply with AWS D1.1.

B. Erection of Wood Supports and Anchorages:

1. Design, cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor plumbing materials and equipment.

2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

3. Attach to substrates as required to support applied loads.

C. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strains and interference with piping connections and maintenance operations.

2. Where saddles are required, use cast-iron or welded-steel saddles with curvature to fit the tank shell.

3. Mount power-driven equipment on common base with driver.

D. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 21.

E. Concrete Housekeeping Pads and Isolation Bases: Work under this section includes coordination of construction of all concrete foundations indicated or required for equipment specified under Division 21. Materials and workmanship shall be described in Division 03 specifications. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at the project.

1. Construct concrete housekeeping pads and isolation bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete pad to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the pad.

3. Install epoxy-coated anchor bolts for supported equipment that extends through concrete pad, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

F. Grouting:

1. Grout under all equipment after leveling, filling completely the space between machinery bed plate and foundation surface as specified in Division 03 specifications.

2. Mix and install grout for plumbing equipment base bearing surfaces, pumps, and other equipment base plates and anchors.

3. Clean surfaces that will come into contact with grout.

4. Provide forms as required for placement of grout.

5. Avoid air entrapment during placement of grout.

6. Place grout, completely filling equipment bases.

7. Place grout on concrete pads and bases to provide smooth bearing surface for equipment.

8. Place grout around anchors.

9. Cure placed grout.

10. Finish exposed surface of grout for a neat appearance.

3.12 CLEANUP

A. In addition to cleanup specified in Division 01 specifications, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. Thoroughly flush and clean all water systems.

C. During the progress of the work, keep the premises clean and free of debris.

3.13 PAINTING

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal pipe, duct, hangers, supports, rods, hardware, and equipment with one coat of rust-inhibiting primer. Galvanized, stainless-steel, or aluminum ductwork, pipe, supports, hangers, rods and hardware, and factory-painted equipment shall be considered as having primed surface.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Comply with requirements specified in Division 09 for finished painting.

3.14 FIRESTOPPING

A. Coordinate with the firestopping installer for sealing of all penetrations of fire and smoke barriers and other rated assemblies created during the installation of the Division 21 work.

1. Comply with requirements specified in Section 07 84 00.

3.15 CONNECTIONS TO SERVICES

A. Provide all connections to water lines, except as otherwise specifically designated. Provide all necessary tees, taps, and connections required to properly connect to building services. Verify all requirements with civil drawings before making any piping connections to water piping and conform to them during installation.

3.16 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace piping systems to prevent vibration or rattling when systems are in operation. Install connections to equipment so that noise and vibration will not reach the conditioned area through piping, conduit, or the building structure.

END OF SECTION

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SECTION 21 05 17

SLEEVES & SLEEVE SEALS FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Sleeves.

2. Sleeve-seal systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast- or ductile-iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded-steel collar; zinc coated.

C. Galvanized-Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded or snap-lock longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.

2. CALPICO, Inc.

3. Link-Seal by GPT, an EnPro Industries Company.

4. The Metraflex Company.

5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel or reinforced nylon polymer.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in concrete floors, concrete roofs, and concrete or masonry walls.

1. Sleeves are not required for core-drilled holes through exterior walls or slab-on-grade floors.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and interior of sleeve.

1. For core-drilled holes, size hole large enough to provide 1-inch annular space between piping and concrete wall or slab-on-grade floor.

C. For sleeves located at building seismic joints, select sleeves of size large enough to provide 5-inch annular clear space between piping and sleeve.

D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level unless otherwise required or indicated.

2. Using grout, seal the space outside of sleeves in slabs and walls.

E. Install sleeves in core-drilled holes in concrete floors in mechanical equipment areas or other wet areas.

1. Extend sleeves 2 inches above finished floor level unless otherwise indicated.

2. Using grout, seal the space outside of sleeves.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 specifications.

3.2 SLEEVE-SEAL SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve or hole. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade: Cast-iron wall sleeves or galvanized-steel wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Exterior Concrete Walls Below Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Foundation or Stem Walls Below Grade: Cast-iron wall sleeves.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve.

4. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

5. Concrete Slabs Above Grade:

a. Non-Rated Floors: Cast-iron wall pipes or galvanized-steel wall pipes.

b. Fire-Rated Floors: Galvanized-steel wall pipes.

6. Interior Concrete or Masonry Walls:

a. Non-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves.

b. Fire-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves as allowed per UL penetration detail.

END OF SECTION

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SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Equipment labels.

2. Warning signs and labels.

3. Valve tags.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

6. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's drawing designation or unique equipment number. Coordinate with the Owner.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

F. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: As indicated on the drawings or required by the local authority.

2.3 VALVE TAGS

A. Plastic Labels for Valves:

1. Material and Thickness: Multilayer, multicolor plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

6. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

7. Fasteners: Beaded chain.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of fire suppression system equipment.

B. Locate equipment labels where accessible and visible.

3.3 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in fire suppression piping systems.

B. Valve tags shall include the following information:

1. Piping System: Wet sprinkler riser, pre-action riser, etc.

2. Area Served: First Floor, Data Room, etc.

3. Function: e.g., Inspector’s Test, Isolation, etc.

3.4 ADJUSTING AND CLEANING

A. Relocate fire suppression identification materials and devices that have become visually blocked by other work.

B. Clean faces of fire suppression identification devices.

END OF SECTION

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SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Pipes, fittings, and specialties.

2. Fire-protection valves.

3. Fire-department connections.

4. Sprinklers.

5. Alarm devices.

6. Pressure gauges.

1.2 SYSTEM DESCRIPTIONS

A. Performance Based Specifications: This section describes requirements necessary to design and install an automatic fire sprinkler system. The licensed Fire Sprinkler Contractor is responsible to design and install the complete fire sprinkler system per NFPA requirements, per the requirements of the Local Authority Having Jurisdiction (AHJ), and per this specification.

B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.3 PERFORMANCE REQUIREMENTS

A. Design and install a complete automatic wet fire sprinkler system as required by national and local codes that meets the requirements of the AHJ. Systems shall be complete with all components specified for each area protected. The system shall be in accordance with the required edition of the following NFPA Standards:

1. NFPA Chapter 13, Sprinkler Systems, Installation.

2. NFPA Chapter 13R, Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.

3. NFPA Chapter 25, Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

4. NFPA Chapter 1963, Fire Hose Connections.

5. NFPA Chapter 14, Standpipe and Hose Systems.

6. NFPA Chapter 15, Water Spray Fixed Systems.

7. NFPA Chapter 24, Private Fire Service Mains.

8. NFPA Chapter 231C, Rack Storage of Materials.

9. Refer to other chapters of the NFPA that are applicable.

B. Provide field verification of all dimensions. No extra charges or compensation will be allowed for any differences between actual dimensions and measurements indicated.

C. The Contractor shall pay for or perform flow tests on systems prior to completing fire sprinkler calculations and shop drawings.

D. Hydraulic design of the system shall be based on a reduction of the measured static pressure by a minimum of 10%, or more if required by the AHJ.

E. Securing and payment for all necessary permits and inspections.

F. Design and install the sprinkler system to the sprinkler occupancy hazard classifications as defined in NFPA and per the AHJ.

G. Minimum Density for Automatic-Sprinkler Piping Design:

1. Residential (Dwelling) Occupancy: 0.05 gpm over 400 square foot area.

2. Light-Hazard Occupancy: 0.10 gpm over 1,500 square foot area.

3. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1,500 square foot area.

4. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1,500 square foot area.

5. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2,500 square foot area.

6. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2,500 square foot area.

7. Include hose stream and fire riser flow rates as required.

H. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Data information is to include pipe material, and manufacturer and model number of all components intended for use on this project.

B. Shop Drawings: For wet-pipe sprinkler systems. Include detailed plans, elevations, sections, details, and attachments to other work. Shop drawing to also include water calculations. Plans and calculations must be approved by the AHJ before they are submitted to the Engineer for review.

C. Provide a letter of acceptance from the Owner’s fire-protection insurer and complete printed instructions on operation of system to the Owner.

D. Welding certificates.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include Contractor's Material and Test Certificate for Aboveground Piping.

F. Field quality-control reports.

G. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test and criteria stated herein.

1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Designer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Underground Piping: Underground piping shall conform to NFPA Standard 24 (Standard for Installation of Private Fire Mains). All pipe and fittings shall be cleaned of all debris, stone, and dirt and inspected for cracks and holes before being laid. All underground piping shall be thoroughly flushed in accordance with the requirements of NFPA 13 and 24. The test must be witnessed by a proper authority.

B. Interior Piping: Piping 2 inches and smaller shall be a minimum of Schedule 40 steel pipe. Piping greater than 2 inches shall be a minimum of Schedule 10 steel pipe. All piping shall conform to the requirements in NFPA 13. All other types of pipe or tube are specifically prohibited. All piping shall be treated to prevent microbial-induced corrosion.

2.2 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.

2. Minimum Pressure Rating: 175 psig.

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.

b. Clow Valve Company; a Division of McWane, Inc.

c. Crane Co.; Crane Valve Group; Crane Valves.

d. Crane Co.; Crane Valve Group; Jenkins Valves.

e. Crane Co.; Crane Valve Group; Stockham Division.

f. Kennedy Valve; a Division of McWane, Inc.

g. Metraflex, Inc.

h. Milwaukee Valve Company.

i. Mueller Co.; Water Products Division.

j. NIBCO INC.

k. Potter Roemer.

l. Reliable Automatic Sprinkler Co., Inc.

m. Shurjoint Piping Products.

n. Tyco Fire & Building Products LP.

o. United Brass Works, Inc.

p. Victaulic Company.

q. Viking Corporation.

r. Watts Water Technologies, Inc.

2. Standard: UL 312.

3. Pressure Rating: 250 psig minimum.

4. Type: Swing check.

5. Body Material: Cast or ductile iron.

6. End Connections: Flanged or grooved.

C. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Stockham Division.

c. Milwaukee Valve Company.

d. NIBCO INC.

e. United Brass Works, Inc.

2. Standard: UL 262.

3. Pressure Rating: 175 psig.

4. Body Material: Bronze.

5. End Connections: Threaded.

D. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.

b. American Valve, Inc.

c. Clow Valve Company; a Division of McWane, Inc.

d. Crane Co.; Crane Valve Group; Crane Valves.

e. Crane Co.; Crane Valve Group; Jenkins Valves.

f. Crane Co.; Crane Valve Group; Stockham Division.

g. Hammond Valve.

h. Milwaukee Valve Company.

i. Mueller Co.; Water Products Division.

j. NIBCO INC.

k. Tyco Fire & Building Products LP.

l. United Brass Works, Inc.

m. Victaulic Company.

n. Watts Water Technologies, Inc.

2. Standard: UL 262.

3. Pressure Rating: 250 psig minimum.

4. Body Material: Cast or ductile iron.

5. End Connections: Flanged or grooved.

E. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.

b. Fivalco Inc.

c. Global Safety Products, Inc.

d. Kennedy Valve; a Division of McWane, Inc.

e. Milwaukee Valve Company.

f. NIBCO INC.

g. Shurjoint Piping Products.

h. Tyco Fire & Building Products LP.

i. Victaulic Company.

2. Standard: UL 1091.

3. Pressure Rating: 175 psig minimum.

4. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.

b. Body Material: Bronze.

c. End Connections: Threaded or grooved.

5. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.

b. Body Material: Cast or ductile iron.

c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Weatherproof housing with integral electrical, 115 VAC, prewired, 2-circuit, supervisory switch indicating device.

2.3 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's Fire Protection Equipment Directory listing or Approval Guide, published by FM Global listing.

2. Minimum Pressure Rating: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.

b. Conbraco Industries, Inc.; Apollo Valves.

c. Milwaukee Valve Company.

d. NIBCO INC.

e. Victaulic Company.

f. Watts Water Technologies, Inc.

2.4 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's Fire Protection Equipment Directory listing or Approval Guide, published by FM Global listing.

2. Minimum Pressure Rating: 175 psig.

3. Body Material: Cast or ductile iron.

4. Size: Same as connected piping.

5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.

b. Globe Fire Sprinkler Corporation.

c. Reliable Automatic Sprinkler Co., Inc.

d. Tyco Fire & Building Products LP.

e. Victaulic Company.

f. Viking Corporation.

2. Standard: UL 193.

3. Design: For horizontal or vertical installation.

4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.

5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping if retarding chamber is required, or else pipe drain with check valve to main drain piping.

C. Automatic Ball Drip Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.

b. Reliable Automatic Sprinkler Co., Inc.

c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.

3. Pressure Rating: 175 psig minimum.

4. Type: Automatic draining, ball check.

5. Size: NPS 3/4.

6. End Connections: Threaded.

2.5 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.

b. Elkhart Brass Mfg. Company, Inc.

c. GMR International Equipment Corporation.

d. Guardian Fire Equipment, Inc.

e. Potter Roemer.

2. Standard: UL 405.

3. Type: Flush, for wall mounting.

4. Pressure Rating: 175 psig minimum.

5. Body Material: Corrosion-resistant metal.

6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

7. Caps: Brass, lugged type, with gasket and chain, or as directed by local fire department.

8. Locking Caps: KNOX FDC Plug, stainless steel, locking plug to protect hose connections from damage. Finish as selected by the Architect.

9. Escutcheon Plate: Rectangular, brass, wall type.

10. Outlet: With pipe threads.

11. Body Style: Horizontal.

12. Number of Inlets: Two.

13. Outlet Location: Back.

14. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."

15. Finish: Polished chrome plated.

16. Outlet Size: NPS 4.

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.

b. Reliable Automatic Sprinkler Co., Inc.

c. Tyco Fire & Building Products LP.

d. Victaulic Company.

2. Standard: UL's Fire Protection Equipment Directory listing or Approval Guide, published by FM Global listing.

3. Pressure Rating: 175 psig minimum.

4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.

5. Size: Same as connected piping.

6. Inlet and Outlet: Threaded or grooved.

B. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.

b. Triple R Specialty.

c. Tyco Fire & Building Products LP.

d. Victaulic Company.

e. Viking Corporation.

2. Standard: UL's Fire Protection Equipment Directory listing or Approval Guide, published by FM Global listing.

3. Pressure Rating: 175 psig minimum.

4. Body Material: Cast- or ductile-iron or cast-bronze housing with sight glass.

5. Size: Same as connected piping.

6. Inlet and Outlet: Threaded.

C. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.

b. FlexHead Industries, Inc.

c. Gateway Tubing, Inc.

d. Victaulic Company.

2. Standard: UL 1474.

3. Type: Flexible hose for connection to sprinkler and with bracket for connection to ceiling grid.

4. Pressure Rating: 175 psig minimum.

5. Size: Same as connected piping, for sprinkler.

2.7 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc.

2. Tyco Fire & Building Products LP.

3. Victaulic Company.

4. Viking Corporation.

B. General Requirements:

1. Standard: UL's Fire Protection Equipment Directory listing or Approval Guide, published by FM Global listing.

2. Pressure Rating for Residential Sprinklers: 175 psig maximum.

3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.

2. Non-Residential Applications: UL 199.

3. Residential Applications: UL 1626.

4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler finishes, as selected by the Architect:

1. Chrome plated.

2. Bronze.

3. Factory painted or coated.

4. Stainless steel.

E. Sprinkler Escutcheons: Materials, types, and finishes as selected by the Architect for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated, painted, or coated steel, one piece, flat.

2. Sidewall Mounting: Chrome-plated, painted, or coated steel, one piece, flat.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc.

b. Tyco Fire & Building Products LP.

c. Victaulic Company.

d. Viking Corporation.

2. Standard: UL 199.

3. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm device types shall match piping and equipment connections.

B. Electrically-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Edwards Signaling.

b. Globe Fire Sprinkler Corporation.

c. Mircom.

d. System Sensor.

e. Tyco Fire & Building Products LP.

2. Standard: UL 464.

3. Type: Electrically operated.

4. Voltage: 120 VAC.

5. Alarm Gong: Cast aluminum with red-enamel factory finish.

6. Size: 10-inch diameter.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ADT Security Services, Inc.

   b. McDonnell & Miller; ITT Industries.

   c. Potter Electric Signal Company.

   d. System Sensor; a Honeywell company.

   e. Viking Corporation.

   f. Watts Industries (Canada) Inc.

2. Standard: UL 346.

3. Water-Flow Detector: Electrically supervised.

4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125 VAC and 0.25 A, 24 VDC; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

5. Type: Paddle operated.

6. Pressure Rating: 250 psig.

7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell company.

   b. Kennedy Valve; a Division of McWane, Inc.

   c. Potter Electric Signal Company.

   d. System Sensor; a Honeywell company.

2. Standard: UL 346.

3. Type: Electrically supervised.

4. Components: Single-pole, double-throw switch with normally closed contacts.

5. Design: Signals that controlled valve are in other than fully open position.

2.9 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.

2. Ashcroft, Inc.

3. Brecco Corporation.

4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2-inch to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0 to 250 psig minimum.

E. Water System Piping Gauge: Include “WATER” or “AIR/WATER” label on dial face.

F. Air System Piping Gauge: Include retard feature and “AIR” or “AIR/WATER” label on dial face.

PART 3 - EXECUTION

3.1 WATER-SUPPLY CONNECTIONS

A. Prior to connecting sprinkler piping to interior water distribution piping, verify that flushing of piping has been completed.

B. Connect sprinkler piping to building’s interior water-distribution piping.

C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Piping and sprinkler head locations are to be coordinated in the field with other trades and the final ceiling layout.

1. Deviations from approved working plans for piping require written approval from AHJs. File written approval with the Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping where required. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install Inspector's Test Connections in sprinkler system piping, complete with label and shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic, ball drip, drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to spill-over floor sink or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at the top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft metal-seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors.

P. Install sleeve seals for piping penetrations of concrete walls and slabs.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

R. Install flexible couplings within 24 inches of building expansion joints.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings the same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and AHJs.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves where required in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid.

C. Install flexible sprinkler hose fittings into bracket on ceiling grid.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic, ball drip drain valve at each check valve for fire-department connection.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13, Systems Acceptance Chapter.

4. Energize circuits to electrical equipment and devices.

5. Start and run excess-pressure pumps.

6. Coordinate with fire-alarm tests. Operate as required.

7. Verify that equipment hose threads are the same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.10 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Concealed sprinklers.

3. Public Rooms with Hard-Lid Ceilings, such as Lobbies, Meeting Rooms, Conference Rooms, etc.: Concealed sprinklers.

4. Non-Public Rooms with Hard-Lid Ceilings, such as Storage Rooms, Restrooms, Corridors, etc.: Concealed sprinklers.

5. Wall Mounting: Sidewall sprinklers.

6. Spaces Subject to Freezing: Pendent or sidewall dry sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

2. Flush Sprinklers: Bright chrome, with painted white escutcheon.

3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

4. Residential Sprinklers: Dull chrome.

5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

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3.01 PREPARATION

A. Field Measurements: Verify dimensions in field for work fitted to other construction before proceeding.

3.02 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions, reviewed shop drawings, and requirements of regulatory agencies including ASME A17.1, ASME A18.1.

B. Install system components and connect to building utilities.

C. Manufacturer's Nameplates: Including trademark and other identifying symbols are not permitted on visible surfaces.

D. Fasteners: Finish to match adjacent surfaces.

E. Startup equipment in accordance with manufacturer's instructions.

F. Adjust for smooth operation.

3.03 FIELD QUALITY CONTROL

A. Inspection: Assure workmanship and equipment complies with Contract Documents.

B. Tests: Perform tests in accordance with ASME A17.1 and ASME A18.1 and as required by authorities having jurisdiction.

C. Operations: Demonstrate that operations comply with specified requirements.

D. Correction: Replace or remedy defects and discrepancies at no cost to Owner.

3.04 PROTECTION

A. Protect finished surfaces until final completion; replace damaged materials.

3.05 MAINTENANCE

A. General: After Substantial Completion, provide following maintenance for a period of 12-months.

1. Examinations: Six times per year, including adjustments, cleaning and lubrication of equipment.

2. Replacements: Replace mechanical and electrical parts when required, using parts produced by original manufacturer.

3. Parts: Maintain adequate supply of spare parts.

END OF SECTION

DIVISION 22

PLUMBING

END OF INDEX

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SECTION 22 05 00

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

A. Provisions of this section apply to all work specified in all sections under Division 22.

B. In addition, work in Division 22 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections in Division 01, General Requirements.

C. The Contract Documents do not specify exact installation means and methods or Contractor safety procedures. Installation means and methods and safety procedures are the responsibility of the Contractor. No instruction or statement made on the Contract Documents shall be interpreted to shift this responsibility away from the Contractor.

D. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.

1.2 DEFINITIONS

A. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unconditioned shelters.

B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in duct shafts, and in utility chases.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and mechanical yards.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include finished spaces and mechanical equipment rooms.

E. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unconditioned spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and utility tunnels.

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and project conditions, and pay all costs necessary to perform the work.

1.4 PLUMBING CONTRACTOR

A. The Plumbing Contractor shall hold a current contracting license that has been valid for a minimum of 2 years in the State of Arizona as a plumbing contractor.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, disposal, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01 specifications.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01 specifications.

1.6 DRAWINGS AND SPECIFICATIONS

A. Refer to Division 01 specifications for additional information on submittals and shop drawings.

B. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be Contract Documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

B. Product Information Sheets: Provide project specific manufacturer’s literature which includes the information required by the Product Data paragraph of the applicable specification section. Where product information sheets show multiple models or options, clearly mark the model and options to be provided.

C. Assembly: Assemble all required submittal information for each specification section and submit in PDF format.

1. Assemble PDF submittals in one PDF file for each division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.

2. Partial submittals and submittals that are not project specific will be returned without review.

D. Identification and Information:

1. Name the PDF file with the project name, division number and sequential submittal number (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2).

2. Provide a cover sheet at the front of each submittal with the following information:

a. Project name.

b. Date.

c. Name of Engineer.

d. Name of Contractor.

e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

a. Name of supplier.

b. Name of manufacturer.

c. Number and title of appropriate specification section.

d. Drawing number and detail references, as appropriate.

e. Other necessary identification.

E. Options:

1. Identify options requiring selection by the Engineer.

2. Identify options included with submittal item.

F. Deviations: Identify deviations from the Contract Documents on submittals.

G. Furnished by Others: This project is to provide a complete and functional system. Where material or labor is indicated in the submittal to be provided "by others" clearly indicated who is providing those items and include information to indicate proper coordination.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current Material Safety Data Sheets (MSDS) for all hazardous materials that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of 1 week prior to the delivery of any hazardous materials to the site.

2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the Contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information (RFI):

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.

2. A properly prepared request for information shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specification in need of clarification and the nature of the clarification requested.

   a. Drawings shall be identified by drawing number and location on the drawing sheet.

   b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based upon the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the Contract Documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner who may deduct an equal amount from the monies due the Contractor.

1.10 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings.

1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Include all equipment, and underground and overhead piping.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

   b. Include dimensions both horizontally and vertically to permanent points of reference, accurate within 6 inches. Include descriptors such as "below slab," "above ceiling," etc.

   c. Record data daily or as soon as possible after obtaining it.

   d. Record and check the markup before enclosing concealed installations.

2. Mark the As-Built Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of As-Built Drawings.

3. Mark the As-Built Drawings with erasable, red colored pencil, or in a digital PDF format using an editor program such as Bluebeam, Adobe Acrobat Professional, or similar. Use other colors to distinguish between changes for different categories of the work at the same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

5. Update the As-Built Drawings weekly or daily as appropriate for the project size.

B. Format: Identify and date each As-Built Drawing; include the designation “PROJECT AS-BUILT DRAWING” in a prominent location.

1. Organize newly-prepared As-Built Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification, as follows:

a. Project name.

b. Date.

c. Designation “PROJECT AS-BUILT DRAWINGS.”

d. Name of Engineer.

e. Name of Contractor.

3. Remove or obscure the Engineer’s seal and signature from As-Built Drawings.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment, operation and maintenance manual for all equipment supplied under Division 22.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to Substantial Completion for review and comment.

2. Submit the final version the manual not more than 4 weeks after Substantial Completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF Electronic Files: Assemble each manual into a single master directory with subdirectories for the individual PDF files for each system and piece of equipment. Provide a table of contents file with hyperlinks to each of the individual PDF files within the subdirectories. Submit on digital media acceptable to Engineer.

a. Name each directory, subdirectory, and document file with applicable item name.

b. Enable reviewer comments on draft submittals.

2. Paper Copies: Assemble paper copies in 3-ring binders. Separate and order systems and equipment within each binder. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab. Enclose title pages and directories in clear plastic sleeves.

D. Provide operating and maintenance manuals for all systems, subsystems, and equipment that require operation and regular maintenance, or have replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturer's maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this section, include operation and maintenance data required in individual specification sections.

F. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of installer or supplier and maintenance service agent, and cross-reference specification section number and title in Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Approved submittals.

3. Include the following if not shown on approved submittals:

a. Product name and model number. Use designations for products indicated on Contract Documents.

b. Manufacturer's name.

c. Equipment identification with serial number of each component.

d. Equipment function.

e. Operating characteristics.

f. Limiting conditions.

g. Performance curves.

h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures. Including precautions against improper use.

10. Operating logs.

I. Wiring Diagrams: Diagram of factory-installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification. Include valve locations and designations.

L. Manufacturer's Maintenance Documentation: Provide manufacturer's maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

M. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

N. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

O. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

P. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

Q. Licenses: Include copies of any licenses with requirements including inspection and renewal dates.

R. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1.12 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of same type or classification by the same manufacturer.

1.13 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 specifications for description of material and equipment for prior approvals and substitutions.

1.14 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. Refer to Division 01 specifications for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 22 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 22.

1.15 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and legally disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused piping, controls and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling unless noted otherwise.

C. Disconnect, demolish, and remove plumbing systems, equipment, and components that are indicated to be removed.

1. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Patch insulation, as required, to match adjacent areas.

2. Piping to be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Equipment and Fixtures to be Removed: Disconnect and cap services and remove equipment and fixtures.

D. Rerouting and Relocation of Existing Plumbing Equipment and Services in Existing Building:

1. General: Contractor shall reroute, relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.

2. Existing Piping: Where applicable, existing material may be reused in their original location unless otherwise indicated.

E. Testing: All existing services affected by the new construction and which are modified, reused or are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.16 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment and such facilities shall be kept clear of materials or equipment. Refer to Division 01 specifications for additional requirements.

B. Furnish and maintain from the beginning to the completion of all work all lawful and necessary security, guards, railings, fences, canopies, lights, fire protection, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.17 GUARANTEE

A. Guarantee all material, equipment, installation and workmanship for all sections under Division 22 in writing to be free from defects of material and workmanship for 1 year from date of final acceptance as outlined in Division 01 specifications. Equipment warranties shall be a minimum of 1 year from date of Substantial Completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions.

1.18 ELECTRICAL WORK

A. Electrical wiring, including power wiring and control wiring, except as otherwise specified under Division 22, all raceways, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in Division 26 of the specifications.

B. All loose starters and control devices for equipment furnished under Division 22, except as otherwise specified under Division 22, are to be furnished under that particular section of Division 22 and installed under Division 26.

C. Contractor shall be responsible for the checking and testing of all controls and the interlocks for a complete and satisfactory operating system.

D. Before ordering any motors and equipment, verify the available voltage and phase for all motors with the Division 26 Contractor.

E. Submit a complete list of all motors prior to final closeout of project indicating the location, horsepower, voltage, phase, and amperage draw of each motor.

F. All field wiring and equipment must conform to the applicable Division 26 specification sections.

PART 2 - PRODUCTS

2.1 EQUIPMENT DESIGN AND INSTALLATION

A. Design: Design all equipment in accordance with latest edition of ASME, AGA, UL, and other applicable technical standards as follows:

1. Pressure Vessels: ASME Code constructed and stamped.

2. Electric Appliances: UL labeled.

2.2 GROUT

A. Description: ASTM C1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.

2. Design Mix: 5,000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Submit one copy of PDF submittals via email, project website or other electronic media.

3.2 AS-BUILT DRAWINGS AND RECORD DOCUMENTS

A. Recording: Post changes and modifications to the As-Built Drawings as they occur; do not wait until the end of the project.

B. Maintenance of As-Built Drawings and Record Documents: Store Record Documents in the field office, apart from the Contract Documents used for construction. Do not use project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project Record Documents for the Engineer's reference during normal working hours. As-Built Drawings will be reviewed by the Architect, Owner, and Engineer at each pay request review.

C. Submit As-Built Drawings to the Architect at completion of the project.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Prepare operation and maintenance manuals as directed.

B. Submit a preliminary electronic copy of the operation and maintenance manual to the Engineer for review.

C. Make any corrections noted from the Engineer's review upon receipt of comments and resubmit as required.

D. Submit the final, corrected operation and maintenance manual in both paper and electronic format to the Architect.

3.4 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best sequence and installation methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.5 CUTTING AND PATCHING

A. Cut work and patch per Division 01 specifications as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary design and installation of steel to support equipment and pipes between structural steel unless shown on the structural drawings.

3.6 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.7 EXCAVATION AND BACKFILL

A. Perform all necessary excavation, shoring and backfilling required for the proper laying of all pipes inside the building and premises, and outside as may be necessary. Remove all excess excavated materials from the site or dispose of on site as directed by General Contractor.

B. Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms not less than 18 inches wide but no wider than necessary to provide ample work room. Excavate to provide continuous granular bedding as indicated. Do not cut any trench near or under footings without first consulting the Architect. Comply with OSHA requirements.

C. Provide not less than 4 inches of granular material as pipe bedding. Grade and compact trench bedding accurately prior to laying pipe in trench to provide uniform bearing and support for each section of pipe along its entire length. Dig “bell” holes after the trench bottom has been graded and compacted. Granular material shall be pea gravel or sand.

D. Provide backfilling and compaction in accordance with provisions of these specifications and under the direction of the Architect to the required density.

E. Provide not less than 4 inches of granular material, same as piping bedding, all around pipe. Make the first 2 feet of fill in 6-inch layers, each thoroughly compacted as directed with no puddling, and free from rocks, large clods of earth, leaves, branches, and debris. Compact the rest of the backfill as directed, using in the backfill no rocks larger than 4 inches in diameter, and using no rock in the top 12 inches.

3.8 ACCESSIBILITY

A. Install valves, thermometers, gauges, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the Contract Drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Plumbing Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified in Division 08 specifications.

C. Refer to architectural drawings for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to locate valves, traps, etc., with others to avoid unnecessary duplication of access doors.

E. The Contractor, along with the Owner’s representative, shall complete the Plumbing Accessibility/Clearance Checklist at the end of this section for all plumbing equipment. The chart shall be submitted to the Architect for approval prior to Substantial Completion. All conflicts shall be resolved to the Architect’s and Owner’s satisfaction prior to submission.

3.9 FLASHINGS

A. Flash and counterflash all piping penetrating roofing membrane with flashing per roofing manufacturer's recommendations. Refer to architectural drawings for detailing of pipe penetrations through roof.

B. Flash and counterflash all piping penetrating exterior walls. Refer to architectural drawings for detailing of pipe penetrations through walls.

3.10 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, valves, sensors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

C. Install equipment and piping level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment and piping to allow right-of-way for piping installed at required slope.

F. Do not install any equipment in an application not recommended by the manufacturer.

3.11 EQUIPMENT ROUGH-IN

A. Rough in all equipment and fixtures as designated on the approved submittals and in the Construction Documents. The Contract Drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the Contract Drawings shall be anticipated and provided for under this contract.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all piping, valves, and fittings. Valve and cap all piping stub-outs.

3.12 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment refer to Division 01 specifications and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Obtain rough-in drawings from the Owner or other contractors prior to roughing-in any services.

C. Provide all services required. Valve and cap all piping, and leave in a clean and orderly manner.

3.13 EQUIPMENT FINAL CONNECTIONS

A. Provide all piping final connections for all equipment under Division 22 and as indicated on the drawings.

3.14 EQUIPMENT SUPPORTS

A. Erection of Metal Supports and Anchorages:

1. Refer to Division 05 specifications for structural steel.

2. Design, cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment. Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

3. Field Welding: Comply with AWS D1.1.

B. Erection of Wood Supports and Anchorages:

1. Design, cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor plumbing materials and equipment.

2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

3. Attach to substrates as required to support applied loads.

C. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strains and interference with piping connections and maintenance operations.

2. Where saddles are required, use cast-iron or welded-steel saddles with curvature to fit the tank shell.

3. Mount power-driven equipment on common base with driver.

D. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 22.

E. Concrete Housekeeping Pads and Isolation Bases: Work under this section includes coordination of construction of all concrete foundations indicated or required for equipment specified under Division 22. Materials and workmanship shall be described in Division 03 specifications. Anchor equipment to concrete housekeeping pads and isolation bases according to equipment manufacturer’s written instructions and according to seismic codes at project.

1. Construct concrete housekeeping pads and isolation bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete pads to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the pad.

3. Install epoxy-coated anchor bolts for supported equipment that extends through concrete pad, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

F. Grouting:

1. Grout under all equipment after leveling, filling completely the space between machinery base plate and foundation surface as specified in Division 03 specifications.

2. Mix and install grout for plumbing equipment base bearing surfaces, pumps and other equipment base plates, and anchors.

3. Clean surfaces that will come into contact with grout.

4. Provide forms as required for placement of grout.

5. Avoid air entrapment during placement of grout.

6. Place grout, completely filling equipment bases.

7. Place grout on concrete pads and isolation bases and provide smooth bearing surface for equipment.

8. Place grout around anchors.

9. Cure placed grout.

10. Finish exposed surface of grout for a neat appearance.

3.15 CLEANUP

A. In addition to cleanup specified in Division 01 specifications, thoroughly clean all parts of the equipment and fixtures. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. Thoroughly flush and clean all water systems.

C. During the progress of the work, keep the premises clean and free of debris.

3.16 PAINTING

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal with one coat of rust-inhibiting primer. Stainless-steel, aluminum, galvanized, and factory-painted equipment shall be considered as having primed surface.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Finished painting is specified in Division 09 specifications.

3.17 FIRESTOPPING

A. Coordinate with the firestopping installer for sealing of all penetrations of fire and smoke barriers and other rated assemblies created during the installation of the Division 22 work.

3.18 CONNECTIONS TO SERVICES

A. Provide all connections to sanitary sewer lines, storm water lines, gas lines, and water lines, except as otherwise specifically designated. Provide all necessary tees, taps and connections required to properly connect to all building services. Verify all requirements with civil drawings before making any piping connections to sanitary sewer, storm sewer, water or gas piping and conform to them during installation.

3.19 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace piping systems to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through piping, conduit, or the building structure.

3.20 WELDING

A. Procedures:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

2. Architect’s inspector or authorized representative will review performance qualification records of individual welders.

END OF SECTION

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DIVISION 22 ACCESSIBILITY/CLEARANCE CHECKLIST									
Bldg.	Location	Unit #	Acceptable Access		Conflict	Date	Action	Observer	
			Yes	No				Owner	Contractor

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SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general requirements for single-phase and polyphase, general-purpose, horizontal and vertical, small and medium, squirrel-cage induction motors for use on AC power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this section except when stricter requirements are specified in plumbing equipment schedules or sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104°F and at altitude of 3,300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multi-Speed Motors: Variable-torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel-cage.

F. Bearings: Regreasable, shielded, anti-friction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multi-Speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. Bearing Protection Device: Field- or factory-applied shaft grounding ring consisting of metal ring supporting carbon microfibers to provide grounding path between shaft and motor casing.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

5. Electronically commutated.

B. Multi-Speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONICALLY COMMUTATED MOTOR

A. Description: Motor with integral electronics to convert incoming AC power to DC power along with controls to vary the speed of the motor based on an internal or external signal.

B. Controls: Provide with internal controls and programming or external inputs, depending on the application, to allow for motor speed control.

C. Motor Protection: Provide with integral safeties to limit motor speed or de-energize motor if operating in an over-temperature or overloaded condition.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 22 05 17

SLEEVES & SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Sleeves.

2. Sleeve seal systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast- or ductile-iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded or snap-lock longitudinal joint.

2.2 SLEEVE SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.

2. CALPICO, Inc.

3. Link-Seal by GPT, an EnPro Industries Company.

4. The Metraflex Company.

5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel or reinforced nylon polymer.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

1. Sleeves are not required for core-drilled holes through exterior walls or slab-on-grade floors.

B. For sleeves that will have sleeve seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and interior of sleeve.

1. For core-drilled holes, size hole large enough to provide 1-inch annular space between piping and concrete wall or slab-on-grade floor.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level unless otherwise indicated.

2. Using grout, seal the space outside of sleeves in slabs and walls.

D. Install sleeves in core-drilled holes in concrete floors in mechanical equipment areas or other wet areas.

1. Extend sleeves 2 inches above finished floor level unless otherwise indicated.

2. Using grout, seal the space outside of sleeves.

E. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 specifications.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 specifications.

3.2 SLEEVE SEAL SYSTEM INSTALLATION

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Center piping in penetration, assemble sleeve seal system components, and install in annular space between piping and sleeve or hole. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade: Cast-iron wall sleeves or galvanized-steel wall sleeves.

2. Exterior Concrete Walls Below Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Foundation or Stem Walls Below Grade: Cast-iron wall sleeves.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve.

4. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

5. Concrete Slabs Above Grade:

a. Non-Rated Floors: Cast-iron wall pipes or galvanized-steel wall pipes.

b. Fire-Rated Floors: Galvanized-steel wall pipes.

6. Interior Partitions:

   a. Non-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves.

   b. Fire-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves as allowed per UL penetration detail.

END OF SECTION

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SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Escutcheons.

2. Floor plates.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw and polished chrome-plated finish.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting, Floor Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Insulated Piping: One-piece, stamped-steel type.

c. Bare Piping: One-piece, cast-brass type.

2. Escutcheons for existing piping shall be split-casting, cast-brass type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

Edition 0308-1009

SECTION 22 05 19

METERS & GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Liquid-in-glass thermometers.

2. Thermowells.

3. Dial-type pressure gages.

4. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETER

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Miljoco Corporation.

b. Palmer Wahl Instrumentation Group.

c. Trerice, H.O. Co.

d. Weiss Instruments, Inc.

e. Winters Instruments – U.S.

2. Standard: ASME B40.200.

3. Case: Cast aluminum, 9-inch nominal size unless otherwise indicated.

4. Case Form: Adjustable angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in degrees F.

7. Window: Glass.

8. Stem: Bare aluminum and of length to suit installation.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

10. Accuracy: ± 1% of scale range or one scale division, to a maximum of 1.5% of scale range.

2.2 THERMOWELLS

A. Standard: ASME B40.200.

B. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

C. Material for Use with Copper Tubing: Brass.

D. Material for Use with Steel Piping: Stainless Steel.

E. Type: Stepped shank unless straight or tapered shank is indicated.

F. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

G. Internal Threads: 1-1/4 inch, with ASME B1.1 screw threads.

H. Bore: Diameter required to match thermometer bulb or stem.

I. Insertion Length: Length required to match thermometer bulb or stem.

J. Lagging Extension: Include on thermowells for insulated piping and tubing.

K. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.3 PRESSURE GAGES

A. Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Marsh Bellofram.

b. Miljoco Corporation.

c. Palmer Wahl Instrumentation Group.

d. Trerice, H. O. Co.

e. Weiss Instruments, Inc.

f. Weksler.

2. Standard: ASME B40.100.

3. Case: Liquid-filled sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Non-reflective aluminum with permanently-etched scale markings graduated in psi.

8. Pointer: Dark-colored metal.

9. Window: Glass.

10. Ring: Metal.

11. Accuracy: Grade A, ± 1% of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 WATER METERS

A. AWWA C700, oscillating-piston or nutating disc, magnetic-drive, totalization meter.

1. Body: Bronze.

B. Maximum Pressure Loss at Design Flow: 3 psig.

C. Registration: Gallons or cubic feet.

D. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250 VAC; and that will close at adjustable increments of total flow.

E. Meter shall match size of adjacent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer and temperature sensor connectors. Include bushings if required to match sizes.

C. Install thermowells as directed by the Building Automation System Contractor.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install valve and snubber in piping for each pressure gage for fluids.

I. Install thermometers where indicated on the drawings and in the following locations:

1. Outlet of each water heater.

2. Two inlets and one outlet of each mixing valve.

3. Inlet and outlet of each thermal-storage tank.

J. Install pressure gages where indicated on the drawings and in the following locations:

1. Discharge of each pressure-reducing valve.

2. Each pump. Provide one gage per pump with tubing and valves to allow measurement at strainer inlet, pump inlet, and pump discharge.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer’s written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Cold- and Hot-Water Piping: 0 to 250°F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range: 0 to 100 psi.

END OF SECTION

Edition 0607-1015

SECTION 22 05 23

GENERAL DUTY VALVES FOR PLUMBING WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Ball valves.

2. Bronze swing check valves.

3. Iron swing check valves.

4. Iron swing check valves with closure control.

5. Iron gate valves.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61-G for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to Plumbing Valve Schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: The same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 6 and larger.

2. Handwheel: For valves other than quarter-turn types.

3. Handlever: For quarter-turn valves NPS 4 and smaller except plug valves.

4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the Valve Installation article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves in Chilled Drinking Water Service: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation. Assembly shall be UL 2043 Classified.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Valve.

2. Conbraco Industries, Inc.; Apollo Valves.

3. FNW.

4. Hammond Valve.

5. Kitz Corporation of America.

6. Milwaukee Valve Company.

7. NIBCO INC.

8. Viega; Plumbing and Heating Systems.

9. Watts Regulator Co.; a Division of Watts Water Technologies, Inc.

2.2 BALL VALVES

A. Two-Piece, Full-Port Ball Valves with Bronze Trim:

1. Standard: MSS SP-110.

2. Compliance: ANSI/NSF 372 lead-free.

3. SWP Rating: 150 psig.

4. CWP Rating: 600 psig.

5. Body Design: Two piece.

6. Body Material:

a. Valves 2 Inches and Smaller: Forged bronze.

b. Valves 2-1/2 Inches and Larger: Forged bronze or brass.

7. Ends: Soldered, pressure-seal, or threaded as indicated below.

8. Seats: PTFE or TFE.

9. Stem: Bronze or brass to match valve body.

10. Ball: Chrome-plated brass.

11. Port: Full.

B. Two-Piece, Full-Port Cast-Iron Ball Valves:

1. Standard: ANSI B16.10.

2. Compliance:

a. ANSI/NSF 61-8 drinking water safe.

b. ANSI/NSF 372 lead-free.

3. SWP Rating: 125 psig.

4. CWP Rating: 200 psig.

5. Body Design: Two piece.

6. Body Material: Epoxy-coated cast iron.

7. Ends: Flanged.

8. Seats: PTFE or TFE.

9. Stem: Stainless steel, blowout proof design.

10. Ball: Teflon fused cast iron or stainless steel.

11. Port: Full.

2.3 CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Standard: MSS SP-80, Type 3.

2. Compliance: ANSI/NSF 372 lead-free.

3. CWP Rating: 200 psig.

4. Body Design: Horizontal flow.

5. Body Material: ASTM B62, bronze.

6. Ends: Threaded.

7. Disc: Bronze.

B. Class 125, Iron Swing Check Valves with Metal Seats:

1. Standard: MSS SP-71, Type I.

2. CWP Rating: 200 psig.

3. Body Design: Clear or full waterway.

4. Body Material: ASTM A126, gray iron with bolted bonnet.

5. Ends: Flanged.

6. Trim: Bronze.

7. Gasket: Asbestos-free.

2.4 CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Standard: MSS SP-71, Type I.

2. CWP Rating: 200 psig.

3. Body Design: Clear or full waterway.

4. Body Material: ASTM A126, gray iron with bolted bonnet.

5. Ends: Flanged.

6. Trim: Bronze.

7. Gasket: Asbestos-free.

8. Closure Control: Factory-installed, exterior lever and weight.

2.5 GATE VALVES

A. Class 125, Non-Rising Stem (NRS), Full-Port, Iron Gate Valves:

1. Standard: MSS SP-70, Type I.

2. CWP Rating: 200 psig.

3. Body Material: ASTM A126, gray iron with bolted bonnet.

4. Ends: Flanged.

5. Trim: Bronze.

6. Disc: Solid wedge.

7. Packing and Gasket: Asbestos-free.

2.6 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.

2. Attachment: For connection to valve stems.

3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.

4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem and handle movement.

E. Install gear actuator with hand wheel axle in horizontal position to prevent accidental engagement or disengagement.

F. Install chainwheels on operators for gate valves NPS 2 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

G. Install chainwheels on operators for all valves located more than 3 feet above a lay-in ceiling. Extend chains to 6 inches above ceiling.

H. Install chainwheels on operators for all valves located more than 2 feet above a hard ceiling access opening. Extend chains to 6 inches above ceiling.

I. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not otherwise indicated, use the following:

1. Shutoff Service: Ball or gate valves.

2. Throttling Service: Ball valves.

3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight.

c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end or pressure-seal valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end or pressure-seal valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 4 and Smaller:

1. Brass and Bronze Valves: NPS 2-1/2 and smaller may be provided with solder-joint ends or pressure-seal ends instead of threaded ends. NPS 3 and larger threaded, pressure-seal, or flanged ends.

2. Ball Valves: Two piece, full port.

3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 5 through NPS 8:

1. Ball Valves: Two piece, full-port, cast iron with flanged ends.

2. Iron Swing Check Valves: Class 125, metal seats.

3. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.

C. Pipe NPS 10 and Larger:

1. Iron Swing Check Valves: Class 125, metal seats.

2. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.

3. Iron Gate Valves: Class 125, NRS.

3.5 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 4 and Smaller:

1. Brass and Bronze Valves: NPS 2-1/2 and smaller may be provided with solder-joint ends instead of threaded ends. NPS 3 and larger threaded or flanged ends.

2. Ball Valves: Two piece, full port, bronze with bronze trim.

3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 5 and Larger:

1. Iron Swing Check Valves: Class 125, metal seats.

2. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.

3. Iron Gate Valves: Class 125, NRS.

END OF SECTION

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SECTION 22 05 29

HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Thermal-hanger shield inserts.

4. Fastener systems.

5. Pipe positioning systems.

6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water with no load transmitted to connected equipment.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include product data for components:

1. Trapeze pipe hangers.

2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers, include analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For tapes, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to Authorities Having Jurisdiction. Factory label tapes with appropriate markings of applicable testing agency.

1. Tape Installed in Return Plenums: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Tape Installed Elsewhere: No testing requirement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers shall be one of the following unless noted otherwise:

1. Anvil International.

2. B-Line.

3. Elcen.

4. Grinnell.

5. Kin-Ling.

6. Michigan Hanger Co.

7. National Pipe Hanger Corp.

8. PHD Manufacturing.

9. PHS Industries.

10. Pipe Technology Products.

11. Unistrut.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Non-Metallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts. Pregalvanized components or hot dip galvanize entire assembly after fabrication where indicated.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot or Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

E. Shield: Shields shall be a minimum of 18 gauge galvanized steel, 12 inches long for piping 6 inches and smaller. Shields shall be a minimum of 16 gauge galvanized steel, 18 inches long for pipe over 6 inches.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

B. Bushings: Plastic, flame retardant bushings may be used at penetrations of steel stubs and steel clips.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes. Pregalvanized components or hot dip galvanize entire assembly after fabrication where indicated.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 plumbing fixture sections for requirements for pipe positioning systems for plumbing fixtures.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating Above Ambient Air Temperature: Clamp may not project through insulation except riser clamp.

b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

	Length	Thickness
NPS 1/4 to NPS 3-1/2	12 inches	0.048 inch
NPS 4	12 inches	0.06 inch
NPS 5 & NPS 6	18 inches	0.06 inch
NPS 8 to NPS 14	24 inches	0.075 inch
NPS 16 to NPS 2	24 inches	0.105 inch

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place non-shrink grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Refer to General Provisions for rust inhibiting primer.

B. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 specifications.

D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system sections.

C. Wrap copper piping with not less than two layers of 10-mil-thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

D. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications. Provide galvanized coating on all hangers and supports outside the insulated building envelope.

E. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1,050°F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

5. Single-Pipe Rolls (MSS Type 43): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

7. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel Turnbuckles (MSS Type 13).

2. Steel Clevises (MSS Type 14): For 120 to 450°F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Include retaining clip.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lbs.

   b. Medium (MSS Type 32): 1,500 lbs.

   c. Heavy (MSS Type 33): 3,000 lbs.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Roof Bases: Unless otherwise indicated, install roof bases for roof-mounted piping and equipment as follows:

1. Select roof base size based on expected load to prevent crushing of the roofing membrane and underlying insulation.

2. Space roof bases as required to properly support pipes or more frequently to distribute the weight of the supported systems to prevent damage to the roofing membrane, underlying insulation, or roofing system.

3. Provide protective pads between each roof base and the roofing membrane. Size pads to extend a minimum of 2 inches beyond each roof base.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system sections.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Equipment labels.

2. Warning signs and labels.

3. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

6. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's drawing designation or unique equipment number, and area(s) served by equipment. Coordinate with Owner.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

F. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: As indicated on drawings or required by local authority.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

1. Complying with latest edition of ANSI/ASME A13.1 unless specifically noted otherwise or directed by Owner.

B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Strap-On Pipe Labels: Semi-rigid plastic formed to fit circumference of pipe and to attach to pipe with stainless-steel worm-drive clamps.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.4 PAINTED PIPE LABELS

A. Paint: Alkyd paint selected for use without a primer based on base material.

B. Color: Match background color indicated in Label Color Schedules below.

C. Application: Use stencils for paint application.

D. Lettering Size: At least 3 inches high.

E. Flow Arrows: To show flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of plumbing equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Comply with requirements in latest edition of ASNI/ASME 13.1 unless noted otherwise.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment. Reduce spacing to 5 feet when required by code.

7. Spaced at maximum 10 feet on piping above removable acoustical ceilings. Reduce spacing to 5 feet when required by code.

C. Use painted pipe labels outside where piping is exposed to weather.

1. Apply one or two coats using the same stencil as required for thorough coverage.

D. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:

a. Background Color: Blue.

b. Letter Color: White.

2. Medium-Pressure, Compressed-Air Piping:

   a. Background Color: Blue.

   b. Letter Color: White.

3. Fuel Oil Piping:

   a. Background Color: Yellow.

   b. Letter Color: Black.

4. Natural Gas Piping:

   a. Background Color: Yellow.

   b. Letter Color: Black.

5. Liquefied Petroleum Gas (LPG) Piping:

   a. Background Color: Yellow.

   b. Letter Color: Black.

6. Domestic Water Piping:

   a. Background Color: Green.

   b. Letter Color: White.

7. Reclaimed Water Piping:

   a. Background Color: Purple.

   b. Letter Color: White.

8. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Green.

   b. Letter Color: White.

3.4 ADJUSTING AND CLEANING

A. Relocate plumbing identification materials and devices that have become visually blocked by other work.

B. Clean faces of plumbing identification devices.

END OF SECTION

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SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes insulating the following plumbing piping services:

1. Domestic water piping.

2. Domestic hot water piping.

3. Domestic recirculating hot water piping.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's technical data with proposed thickness and R-value indicated as well as proposed application.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to Authorities Having Jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following manufacturers:

a. Armacell LLC.

b. K-Flex USA.

F. Mineral-Fiber, Pre-Formed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following manufacturers:

a. Certainteed Corp.

b. Johns Manville; Micro-Lok.

c. Knauf Insulation.

d. Owens Corning.

2. Mineral-Fiber, Pre-Formed Pipe Insulation:

a. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Omit jacket on all but outermost layer where multiple insulation layers are required. Jacket shall comply with the following:

1) ASJ: White, kraft paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2) ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

G. Removable Insulation Wrap:

1. Manufacturers: Subject to compliance with requirements, provide product by No Sweat.

2. Removable Insulation Wrap:

a. Insert: Mineral or glass fibers bonded with a thermosetting resin with a minimum k-factor of 0.26 suitable for use up to 450°F. Maximum flame spread index of 25 and maximum smoke developed index of 50 per ASTM E84. Insert thickness to match thickness of adjacent insulation.

b. Outer Jacket: Tychem wrap consisting of Tyvek fabric made of spunbonded polyolefin with a polyethylene coating to limit vapor permeability. Jacket shall be provided with elastic banding at the ends and a reclosable hook and loop closure system at the seam. Maximum flame spread index of 25 and maximum smoke developed index of 50 per ASTM E84.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.

3. Wet Flash Point: Below 0°F.

4. Service Temperature Range: 40 to 200°F.

5. Color: Black.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: -20 to +180°F.

3. Solids Content: ASTM D1644, 58% by volume and 70% by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: -20 to +180°F.

3. Solids Content: 60% by volume and 66% by weight.

4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.

3. Service Temperature Range: -100 to +300°F.

4. Color: White or gray.

5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: Aluminum.

5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: To match jacket.

5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq.yd. with a thread count of 10 strands x 10 strands/sq.in., in a Leno weave, for pipe.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.

2. Color: As scheduled below.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Finish and thickness are indicated in field-applied jacket schedules.

2. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

3. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

4. Factory-Fabricated Fitting Covers:

   a. Same material, finish, and thickness as jacket.

   b. Pre-formed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

   c. Tee covers.

   d. Flange and union covers.

   e. End caps.

   f. Beveled collars.

   g. Valve covers.

   h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2%.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500%.

5. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5%.

5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.

C. Wire: 0.062 inch, soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Install insulation continuously through hangers and around anchor attachments.

1. At pipe guides, secure spider to pipe and apply insulation through spider per the guide manufacturer's recommendations.

K. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

L. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

M. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

N. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

O. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

P. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.

Q. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

R. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

S. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends below roof surface. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends inside building. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (that are not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 specifications for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 specifications for firestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using pre-formed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with pre-formed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using pre-formed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using pre-formed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized pre-formed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word “union.” Match size and color of pipe labels.

10. Contractor’s Option for Valves and Strainers: Removable insulation wrap system.

    a. Below Ambient Systems or where a Vapor Barrier is Specified:

        1) Provide PVC tape around ends of wrap system to seal wrap to adjacent pipe insulation.

        2) Provide PVC tape closure along seam. Center tape to overlap seam.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pre-formed valve covers manufactured of same material as pipe insulation when available.

2. When pre-formed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PRE-FORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of pre-formed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install pre-formed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install pre-formed sections of same material as straight segments of pipe insulation when available.

2. When pre-formed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pre-formed sections of same material as straight segments of pipe insulation when available.

2. When pre-formed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable pre-formed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping, except hot water return and hot water piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. Insulation shall have a maximum K-factor of 0.27 at a mean rating temperature of 75°F and be one of the following:

a. Flexible Elastomeric: 1/2 inch thick for piping less than 1-1/2 inches; 1 inch thick for piping 1-1/2 inches and larger.

b. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I: 1/2 inch thick for piping less than 1-1/2 inches; 1 inch thick for piping 1-1/2 inches and larger.

B. Domestic Hot and Recirculated Hot Water, 140°F and Lower, Piping:

1. Insulation shall have a maximum K-factor of 0.28 at a mean rating temperature of 100°F and be one of the following:

a. Flexible Elastomeric: 1 inch thick for piping less than 1-1/2 inches; Not permitted for piping 1-1/2 inches and larger.

b. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I: 1 inch thick for piping less than 1-1/2 inches; 1-1/2 inches thick for piping 1-1/2 inches and larger.

C. Domestic Hot and Recirculated Hot Water, Above 140°F, Piping:

1. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I with a Maximum K-Factor of 0.29 at a Mean Rating Temperature of 125°F:

a. 1-1/2 inches thick for piping 1-1/4 inches and smaller; 2 inches thick for piping 1-1/2 inches and larger.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. Insulation shall be mineral-fiber, pre-formed pipe insulation, Type I: 1-1/2 inches thick for pipe 1-1/2 inches and smaller; 2 inches thick for pipe larger than 1-1/2 inches.

B. Domestic Hot and Recirculated Hot Water, 140°F and Lower, Piping:

1. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I shall have a maximum K-factor of 0.28 at a mean rating temperature of 100°F and be the following:

a. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I: 1-1/2 inches thick for piping less than 1-1/2 inches; 2 inches thick for piping 1-1/2 inches and larger.

C. Domestic Hot and Recirculated Hot Water, Above 140°F, Piping:

1. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I shall have a maximum K-factor of 0.29 at a mean rating temperature of 125°F and be the following:

a. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I: 2 inches thick.

3.11 UNDERGROUND PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water, 140°F and Less, Piping:

1. Flexible Elastomeric Insulation with a Maximum K-Factor of 0.28 at a Mean Rating Temperature of 100°F: 1 inch thick for piping less than 1-1/2 inches; 1-1/2 inches thick for piping 1-1/2 inches and larger.

B. Domestic Hot and Recirculated Hot Water, Greater Than 140°F, Piping:

1. Insulation shall be flexible elastomeric:

a. 1-1/2 inches thick for piping less than 1 inch.

b. 2 inches thick for piping 1 inch and larger.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor’s option.

C. Piping, Concealed: None.

D. Piping, Exposed:

1. PVC: 20 mils thick.

a. Color: White.

2. Aluminum, Smooth or Corrugated: 0.016 inch thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor’s option.

C. Piping, Concealed: None.

D. Piping, Exposed: Aluminum, smooth or corrugated with Z-shaped locking seam, 0.020 inch thick.

END OF SECTION

Edition 0908-03/21

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

2. Specialty valves.

3. Flexible connectors.

1.2 DEFINITIONS

A. Domestic Water: Includes softened and un-softened domestic hot and cold water.

1.3 SUBMITTALS

A. Product Data: For each type of pipe and joining material, and for method for joining piping intended for the project.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 Annex G or NSF 372 for low-lead potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in Piping Schedule article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.

2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

5. Copper Pressure-Seal-Joint Fittings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Elkhart Products Corporation; Industrial Division.

2) NIBCO INC.

3) Victaulic Company of America.

4) Viega; Plumbing and Heating Systems.

b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

B. Soft Copper Tube: ASTM B88, Type K and ASTM B88, Type L water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2. Copper Pressure-Seal-Joint Fittings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) NIBCO INC.

2) Viega; Plumbing and Heating Systems.

b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.2.1, non-metallic and asbestos-free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. Dielectric Nipples: Galvanized- or electroplated-steel, or ductile iron nipple with inert and non-corrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

B. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating non-conductive insulating material suitable for system fluid, pressure, and temperature.

1. Dielectric Flanges:

a. Factory-fabricated, bolted, companion-flange assembly.

b. Pressure Rating: 150 psig.

c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2. Dielectric-Flange Kits:

a. Non-conducting materials for field assembly of companion flanges.

b. Pressure Rating: 150 psig.

c. Gasket: Neoprene or phenolic.

d. Bolt Sleeves: Phenolic or polyethylene.

e. Washers: Phenolic with steel backing washers.

2.6 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved.

B. Install copper tubing under building slab according to CDA's Copper Tube Handbook.

C. Install piping buried below the building slab a minimum of 24 inches below slab.

D. Install underground piping outside of the building footprint a minimum of 24 inches below finished grade or minimum of 12 inches below the local frostline, whichever is deeper.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves where facility incoming water pressure exceeds 80 psi.

H. Install domestic water piping level and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Do not install piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe supplying equipment serving the room. Maintain all required clearances to other equipment.

M. Do not install piping above electrical equipment such as transformers, panels, motor control centers, etc., in other rooms.

N. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

O. Install piping adjacent to equipment and specialties to allow service and maintenance.

P. Install piping to permit valve servicing.

Q. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

R. Install piping free of sags and bends.

S. Install factory fabricated fittings for changes in direction and branch connections.

T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Specification Section 22 05 19, Meters and Gages for Plumbing Piping, for pressure gages.

V. Install thermostats in hot-water circulation piping. Comply with requirements in Specification Section “Domestic Water Pumps” for thermostats.

W. Install thermometers on outlet piping from each water heater. Comply with requirements in Specification Section 22 05 19, Meters and Gages for Plumbing Piping, for thermometers.

X. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Specification Section 22 05 17, Sleeves and Sleeve Seals for Plumbing Piping.

Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Specification Section 22 05 17, Sleeves and Sleeve Seals for Plumbing Piping.

Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Specification Section 22 05 18, Escutcheons for Plumbing Piping.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA’s Copper Tube Handbook, Brazed Joints Chapter.

E. Soldered Joints: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA’s Copper Tube Handbook.

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, non-metallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Specification Section 22 05 23, General-Duty Valves for Plumbing Piping, for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 4 and smaller. Use gate valves for piping NPS 5 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Specification Section 22 11 19, Domestic Water Piping Specialties.

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and where indicated on the drawings. Set balancing valves partly open to restrict but not stop flow. Comply with requirements in Specification Section 22 11 19, Domestic Water Piping Specialties, for balancing valves.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.6 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water booster pump.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Specification Section 22 05 29, Hangers and Supports for Plumbing Piping and Equipment, for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.

3. Multiple, Straight, Horizontal Piping Runs: Trapeze hangers with pipe clamps.

B. Support vertical piping and tubing at base and at each floor.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

	Maximum Horizontal Spacing	Minimum Rod Diameter
NPS 3/4 & Smaller	60 inches	3/8-inch rod
NPS 1 & NPS 1-1/4	72 inches	3/8-inch rod
NPS 1-1/2 & NPS 2	96 inches	3/8-inch rod
NPS 2-1/2	108 inches	1/2-inch rod
NPS 3 to NPS 5	10 feet	1/2-inch rod
NPS 6	10 feet	5/8-inch rod

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.

2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture sections for connection sizes.

4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

5. Install automatic trap primers on the cold water supply at the nearest fixture (or where indicated on the drawings) and run drain to trap seal being protected. Provide wall access panel when primers are installed in walls.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements in Specification Section 22 05 53, Identification for Plumbing Piping and Equipment, for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by Authorities Having Jurisdiction (AHJ).

2. During installation, notify the AHJ at least 1 day before inspection must be made. Perform tests specified below in presence of the AHJ:

a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for the AHJ to observe tests specified below and to ensure compliance with requirements.

3. Re-Inspection: If the AHJ finds that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by the AHJ.

C. Piping Tests:

1. Fill domestic water piping using clean, potable water. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 CLEANING

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. Clean and disinfect potable domestic water piping prior to putting into service as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before use with clean, potable water.

2. Use purging and disinfecting procedures prescribed by the AHJ; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for 3 hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to the AHJ for testing of piping cleanliness. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities to Architect/Engineer. Include a copy of final report in Operation and Maintenance Manual.

D. Contractor will be responsible for cleaning and repair of system if microbial induced corrosion is detected within warranty period.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Underground, domestic water, building service piping shall be:

1. Piping NPS 2 and Smaller: Soft copper tube, ASTM B88, Type K; wrought-copper solder-joint fittings; and brazed joints.

2. Piping NPS 2-1/2 and Larger: Hard copper tube, ASTM B88, Type K; wrought-copper solder-joint fittings; and brazed joints.

D. Under-building-slab, domestic water piping shall be:

1. Piping NPS 2 and Smaller: Soft copper tube, ASTM B88, Type L; without joints.

2. Piping NPS 2-1/2 and Larger: Hard copper tube, ASTM B88, Type L; wrought-copper solder-joint fittings; and brazed joints.

3. All under slab copper tube shall be protected with 20-mil plastic sleeving. Use blue sleeving on cold water piping and red sleeving for hot water piping. Sleeving shall extend a minimum of 2 inches above slab.

E. Aboveground domestic water piping, NPS 2 and smaller shall be one of the following:

1. Hard copper tube, ASTM B88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 shall be one of the following:

1. Hard copper tube, ASTM B88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 5 and NPS 6 shall be the following:

1. Hard copper tube, ASTM B88, Type L; cast- or wrought- copper solder-joint fittings; and brazed joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 4 and smaller. Use gate valves with flanged ends for piping NPS 5 and larger.

2. Throttling Duty: Use ball valves for piping NPS 4 and smaller. Use butterfly valves with flanged ends for piping NPS 5 and larger.

3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.

4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

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SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following domestic water piping specialties:

1. Vacuum breakers.

2. Backflow preventers.

3. Water pressure-reducing valves.

4. Balancing valves.

5. Temperature-actuated water mixing valves.

6. Digital water mixing valves.

7. Strainers.

8. Hose bibbs.

9. Wall hydrants.

10. Drain valves.

11. Water hammer arresters.

12. Trap-seal primer valves.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of water piping specialty proposed for this project. Include manufacturer, model number, materials of construction, options and accessories, etc.

1. For thermostatic mixing valves include a copy of the piping diagram.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, Plastics Piping Components and Related Materials, for plastic domestic water piping components.

2. Comply with NSF 61 Annex G for low-lead requirements.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.

2. Body: Bronze, non-removable, with manual drain.

3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

4. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Conbraco Industries, Inc.

2. FEBCO.

3. Mifab, Inc., Beeco

4. Watts Industries, Inc.; Water Products Division.

5. Wilkins.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.

2. Operation: Continuous-pressure applications.

3. Pressure Loss: 12 psig maximum, through middle one-third of flow range.

4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved, steel with interior lining complying with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 and larger.

5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

6. Configuration: Designed for horizontal, straight through flow.

7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

b. Wye Pattern Strainer.

c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Backflow Preventers for Carbonated Beverage Dispensers:

1. Standard: ASSE 1022.

2. Body: Stainless steel.

3. Style: Dual check with atmospheric port.

4. Operation: Continuous-pressure applications.

5. End Connections: Threaded or flared.

6. Configuration: Designed for horizontal or vertical installation, straight through flow.

2.3 WATER PRESSURE-REDUCING VALVES

A. Pilot controlled, hydraulically operated single diaphragm actuated pressure reducing valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts ACV Model LFF115 valve or comparable product by one of the following:

a. Cla-Val.

b. Conbraco Industries, Inc.

c. Mifab, Inc., Beeco

d. Wilkins.

2. Pressure Rating: Initial working pressure of 150 psig.

3. Design Outlet Pressure Setting: As indicated on the drawings.

4. Flow Rate:

a. Maximum: Flow indicated on the drawings.

b. Minimum: 1 gallon per minute.

c. Provide parallel valves where required to achieve specified minimum and maximum flows.

5. Size: As indicated on the drawings.

6. Main Valve Body: ASTM A536 ductile iron with NSF listed fusion bonded epoxy liner and coating.

7. Trim: 316 stainless steel.

8. Elastomers: Buna-N or EPDM.

9. Internal Wetted Parts: Coated ductile iron or stainless steel.

10. Pressure Reducing Pilot Valve: Direct acting type valve. Lead-free brass body with Buna-N diaphragm, stainless-steel wetted parts, and aluminum spring cage.

11. Pilot Control Piping and Fittings: Copper tubing with lead-free brass fittings. Provide with Y-strainer and isolation cocks.

12. End Connections: Threaded for NPS 1-1/2 and smaller; flanged for NPS 2 and larger.

2.4 BALANCING VALVES

A. Temperature Actuated, Automatic Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. ThermOmegaTech.

2. Body: Type 303 stainless steel.

3. Plug: Type 303 stainless steel.

4. Thermal Actuator: Type 303 stainless steel.

5. Spring: Type 302 stainless steel.

6. End Connections: Threaded.

7. CWP Rating: Minimum 200 psig.

8. Maximum Operating Temperature: 250°F.

9. Valve Selection: Select automatic balancing valve closing temperature to match the mixing station outlet temperature indicated on the drawings rounded down to the nearest 5°F increment. Valve size is indicated on the drawings.

10. Options: Provide the following factory options:

    a. Stainless-steel union connection with O-ring to allow for valve removal and integrated check valve.

    b. Inlet and outlet full-port, lead-free, bronze ball valves with threaded ends.

    c. Integrated strainer.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Point-of-Use, Water-Temperature Limiting Devices:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawings or a comparable product by one of the following:

a. Bradley.

b. Conbraco Industries, Inc.

c. Lawler Manufacturing Company, Inc.

d. Powers.

e. Symmons Industries, Inc.

f. Watts Industries, Inc.

g. Wilkins.

2. Standard: ASSE 1070.

3. Pressure Rating: 125 psig.

4. Type: Thermostatically controlled, pressure balanced water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.

6. Connections: Threaded or union inlets and outlet.

7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

8. Tempered-Water Setting: 110°F.

9. Tempered-Water Design Flow Rate: 0.5 gpm to 2.5 gpm.

10. Valve Finish: Chrome plated where exposed, rough bronze where concealed.

B. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawings or a comparable product by one of the following:

a. Bradley.

b. Lawler Manufacturing Company, Inc.

c. Powers.

d. Symmons Industries, Inc.

e. Wilkins.

2. Standard: ASSE 1017.

3. Pressure Rating: 125 psig.

4. Type: Cabinet-type, thermostatically controlled water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.

6. Connections: Threaded or union inlets and outlet.

7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.

9. Pressure Drop at Design Flow Rate: 25 psig.

10. Valve Finish: Rough bronze.

11. Piping Finish: Copper.

12. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

2.6 DIGITAL WATER MIXING VALVES

A. Description: Lead-free, ASSE 1017 compliant, factory mounted and piped digital mixing valve complete with inlet hot water, inlet cold water, outlet mixed water, inlet re-circulation return water and outlet return to heater water connections for maintaining constant domestic hot water supply temperature.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the drawings or a comparable product by one of the following:

1. Armstrong.

2. Lawler Valve Co.

3. Powers.

C. Controller: Solid state controller designed to maintain the mixed water setpoint under varying load conditions. Controller shall be provided with a BACnet or MODBUS interface for monitoring and control by the building automation system. Controller shall be provided with a display and interface to allow for the local monitoring and control of the system. This includes displaying setpoints, current inlet and outlet temperatures, error codes and alarm conditions. Controller shall be capable of controlling the hot water circulation pump.

D. Capabilities:

1. Assembly Maximum Operating Pressure: 125 psig.

2. Outlet Temperature Variance: ± 2°F.

3. Automatic shutoff of hot water flow upon loss of power or cold water pressure.

4. Programmable hot water setpoint range of 80°F to 155°F.

5. Maximum Entering Hot Water Temperature: 185°F.

6. Maximum Water Flow: As noted.

7. Minimum Flow: As noted.

8. Minimum Circulation Flow: As noted.

9. Maximum Pressure Drop: As noted.

E. Materials of Construction:

1. Frame: Stainless steel or coated steel sized to support system for floor or wall mounting.

2. Valve Body: Bronze or stainless steel.

3. Piping: Copper with wrought-copper fittings and soldered joints.

F. Connections: Threaded or union inlets and outlet.

G. Accessories: Strainers on all inlet connections, manual full-port ball valves on all connections, thermometers or temperature sensors at all connections, pressure gauges or pressure transducers at all connections.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Perforation Size:

a. Strainers NPS 2 and Smaller: 0.020 inch.

b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.

c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug.

2.8 HOSE BIBBS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chicago.

2. Mifab, Inc.

3. Prier Product, Inc.

4. Jay R. Smith Manufacturing Co.

5. Watts Drainage Products Inc.

6. Woodford Manufacturing Company.

7. Zurn.

B. Standard: ASME A112.18.1 for lawn and sediment faucets.

C. Body Material: Bronze.

D. Seat: Bronze, replaceable.

E. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet as indicated on the drawings.

F. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

G. Pressure Rating: 125 psig.

H. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

I. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.

J. Finish for Service Areas: Rough bronze.

K. Finish for Finished Rooms: Chrome or nickel plated.

L. Operation for Equipment Rooms: Wheel handle or operating key.

M. Operation for Service Areas: Operating key.

N. Operation for Finished Rooms: Operating key.

O. Include operating key with each operating-key hose bibb.

P. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chicago.

2. Mifab, Inc.

3. Prier Product, Inc.

4. Jay R. Smith Manufacturing Co.

5. Watts Drainage Products Inc.

6. Woodford Manufacturing Company.

7. Zurn.

B. Non-Freeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.

2. Pressure Rating: 125 psig.

3. Operation: Loose key.

4. Casing and Operating Rod: Of length required for freeze rating. Include wall clamp.

5. Inlet: NPS 3/4 or NPS 1 as indicated on the drawings.

6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

7. Box: Deep, flush mounting with cover.

8. Lock: Quarter-turn matched to operating key.

9. Box and Cover Finish: Polished nickel bronze.

10. Operating Keys(s): One with each wall hydrant.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.

2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 3/4.

4. Body: Copper alloy.

5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.

8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER HAMMER ARRESTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mifab, Inc.

2. PPP Inc.

3. Sioux Chief Manufacturing Company, Inc.

4. Jay R. Smith Manufacturing Co.

5. Watts Drainage Products Inc.

6. Zurn.

B. Standard: ASSE 1010 or PDI-WH 201.

C. Type: Metal bellows or copper tube with piston.

D. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.12 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mifab, Inc.

b. PPP Inc.

c. Sioux Chief Manufacturing Company, Inc.

d. Jay R. Smith Manufacturing Co.; a Division of Smith Industries, Inc.

e. Watts Industries, Inc.; Water Products Division.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.13 ELECTRONIC TRAP PRIMER VALVES

A. Supply Type, Electronic Trap Priming Assembly:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mifab, Inc.

b. PPP Inc.

c. Sioux Chief Manufacturing Company, Inc.

d. Zurn Plumbing Products Group.

2. Standard: ASSE 1044.

3. Pressure Rating: 125 psig minimum.

4. Style: Recessed cabinet in finished locations and new construction. NEMA 1 cabinet in retrofit applications or unfinished areas with masonry walls.

5. Number of Openings: As required for application or as noted.

6. Inlet Connections: NPS 3/4 with shutoff valve.

7. Outlet Connection: 1/2-inch compression.

8. Backflow Prevention: Anti-siphon atmospheric vacuum breaker, ASSE 1001.

9. Electrical: 120V, 1 phase, circuit breaker, manual override, 24-hour timer, UL listed solenoid valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers at connection points of domestic water system to water-service piping. Comply with Authorities Having Jurisdiction (AHJ).

B. Install backflow preventers in each water supply to equipment and water systems that may be sources of contamination. Comply with the AHJ.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install water pressure-reducing valves where supply water pressure exceeds 80 psig and where indicated on the drawings. Install water pressure-reducing valves with inlet and outlet shutoff valves, and full size bypass with isolation valve. Install pressure gages on inlet and outlet.

D. Install balancing valves where indicated on the drawings in locations where they can be easily accessed.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install digital water mixing valves where indicated on the drawings. Provide with isolation valves at all connections if valves are not part of assembly.

G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, backflow preventer without integral strainer, solenoid valve, and pump.

1. Install shut-off valve upstream and downstream of each strainer

H. Install non-freeze wall hydrants in exterior walls and other locations as noted on the drawings.

I. Install wall hydrants in interior locations susceptible to vandalism or damage such as student areas in schools, loading docks, etc., and other locations as noted on the drawings.

J. Install hose bibbs in interior locations not susceptible to vandalism and other locations as noted on the drawings.

K. Install water hammer arresters in water piping according to PDI-WH 201.

L. Install trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1%, and connect to floor-drain or floor-sink body, trap, or inlet fitting. Adjust valve for proper flow.

1. Trap-seal primer valves are not required where barrier-type trap sealers are provided.

2. Install trap primer valves at all floor drains or floor sinks where indicated on the drawings.

a. Install supply-type valves where floor drains and floor sinks are in close proximity to flush valves.

b. Install electronic valves where floor drains and floor sinks are not in close proximity to flush valves.

M. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.

2. Water pressure-reducing valves.

3. Primary, thermostatic, water mixing valves.

N. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Specification Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer assembly according to the AHJ and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure setpoints of water pressure-reducing valves.

B. Set field-adjustable temperature setpoints of water mixing valves.

C. Set temperature limiting devices to a maximum of 120°F unless noted otherwise.

END OF SECTION

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SECTION 22 11 23

DOMESTIC HOT WATER RECIRCULATING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. In-line, seal-less centrifugal pumps.

2. In-line, close-coupled centrifugal pumps.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions.

3. Equipment dimensions.

4. Required clearances.

5. Electrical data.

a. Motor horsepower.

b. Voltage/Phase/Hz.

6. Materials of construction.

7. Accessories and options.

8. Controls.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. Hydraulic Institute Standards: HI 1.4.

PART 2 - PRODUCTS

2.1 IN-LINE, SEAL-LESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.

2. Grundfos Pumps Corp.

3. TACO.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, seal-less, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal or vertical.

2. Casing: Stainless steel with threaded or companion-flange connections.

3. Impeller: Plastic or stainless steel.

4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics:

1. Minimum Working Pressure: 125 psig.

2. Maximum Continuous Operating Temperature: 220°F.

3. Pump Control: Aquastat and timer.

4. Electrical Characteristics:

a. Volts: 120.

b. Phases: Single.

c. Hertz: 60.

2.2 IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.

2. Bell & Gossett Domestic Pump; ITT Corporation.

3. PACO Pumps.

4. TACO.

5. Weiman; a Division of Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontally or vertically.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 and smaller pipe connections and flanged connections for pumps with NPS 2-1/2 and larger pipe connections.

2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.

3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.

4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.

5. Bearings: Oil-lubricated; bronze-journal or ball type.

6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

E. Capacities and Characteristics:

1. Casing Material: Stainless steel.

2. Impeller Material: Stainless steel.

3. Minimum Working Pressure: 175 psig.

4. Maximum Continuous Operating Temperature: 225°F.

5. Pump Control: Aquastat and Timer.

6. Electrical Characteristics:

a. Volts: 120.

b. Phases: Single.

c. Hertz: 60.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Specification Section 22 05 13, Common Motor Requirements for Plumbing Equipment.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor or pipe clamp-on, for installation in or on piping.

2. Range: 50 to 125°F.

3. Enclosure: NEMA 250, Type 4X.

4. Operation of Pump: On or off.

5. Transformer: Provide if required.

6. Power Requirement: 24 VAC or 120 VAC.

7. Settings: Start pump at 105°F and stop pump at 110°F.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, 7-day clock with manual override on-off switch.

2. Enclosure: NEMA 250, Type 1 suitable for wall mounting.

3. Operation of Pump: On or off.

4. Transformer: Provide if required.

5. Power Requirement: 24 VAC or 120 VAC.

6. Programmable Sequence of Operation: Up to two on-off cycles each day for 7 days.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, centrifugal pumps per manufacturer’s recommendations.

C. Install thermostats in or on hot-water return piping.

D. Install timers on wall adjacent to pump or as indicated on the drawings.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Specification Section 22 11 16, Domestic Water Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Specification Section 22 05 23, General-Duty Valves for Plumbing Piping, and comply with requirements for strainers specified in Specification Section 22 11 19, Domestic Water Piping Specialties.

2. Install a single pressure gage at each pump connected to the suction and discharge of each pump with valves to allow for individual measurement of pump pressures. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Specification Section 22 05 19, Meters and Gages for Plumbing Piping.

D. Connect aquastats and timers to pumps that they control.

3.3 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature setpoints.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

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SECTION 22 13 16

SANITARY WASTE & VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Pipe, tube, and fittings.

2. Specialty pipe fittings.

1.2 DEFINITIONS

A. Grease Waste Piping: Waste piping upstream of grease interceptor or grease trap.

1.3 SUBMITTALS

A. Product Data: For each type of pipe and joining material, and for method for joining piping intended for the project.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in the Piping Schedule article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 EPOXY-COATED, HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A888 or CISPI 301, coated inside and out with a fusion bonded epoxy coating complying with Sections 4.6 and 5.7 of European Standard EN 877.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Charlotte Pipe and Foundry.

b. NewAge Casting.

B. Epoxy Tape: Butyl rubber tape with polypropylene fleece cover. Furnished by the pipe manufacturer, used to cover uncoated ends of pipe after cutting.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Product: Subject to compliance with requirements, provide one of the following products:

a. ANACO-Husky, SD 4000.

b. Ideal Clamp Products, Ideal Tridon Heavy Duty HD Coupling.

c. Mifab, Inc., MI-QXHUB.

d. Mission, HeavyWeight Coupling.

e. NewAge Casting, Extra Heavy Duty Coupling.

2. Standards: ASTM C1540.

3. Description: Type 304 stainless-steel shield with minimum four stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Standard-Duty, Hubless-Piping Couplings:

1. Product: Subject to compliance with requirements, provide one of the following products:

a. ANACO, No Hub Coupling.

b. Ideal Clamp Products, Ideal Tridon Standard Duty Coupling.

c. Mifab, Inc., Regular Duty Coupling.

d. Mission, No Hub Coupling.

e. NewAge Casting, Standard Couplings.

2. Standards: ASTM C1277.

3. Description: Type 301 stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.3 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, non-metallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B32, lead-free with ASTM B813, water-flushable flux.

2.4 HUB-AND-SPIGOT, STAINLESS-STEEL SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Blucher.

2. Josam Company.

B. Standard: ANSI/ASME A112.3.1.

C. Description: Type 316L, lightweight, welded-seam, stainless-steel push-fit pipe and fittings.

D. Gaskets: EPDM rubber fit in hub end of pipe and fittings.

E. Fittings: DWV pattern to match piping.

2.5 GALVANIZED STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53, hot-dipped galvanized, Schedule 40 steel with plain ends; welded and seamless, Grade B.

B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150, galvanized.

C. Malleable-Iron Unions: ASME B16.39; Classes 150, galvanized.

D. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 125; galvanized, raised ground face, and bolt holes spot faced.

E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, galvanized, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Standard: ASTM C1460.

4. Description: Rubber sleeve with full-length, stainless-steel shield and stainless-steel bands with tightening mechanism.

5. Shielded, Non-Pressure Transition Couplings:

a. Copper Piping to Plastic Piping:

1) Product: Subject to compliance with requirements, provide the following product:

a) Fernco Proflex.

b) Mifab, Inc.

c) Mission Band-Seal.

b. Cast Iron Piping to Plastic Piping:

1) Product: Subject to compliance with requirements, provide the following product:

a) ANACO-Husky, SD 4200.

b) Mifab, Inc., MI-QXHUB.

c. Cast Iron Piping to Copper Piping:

1) Product: Subject to compliance with requirements, provide the following product:

a) Fernco Proflex.

b) Mifab, Inc.

c) Mission Band-Seal.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Do not install piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe supplying equipment serving the room. Maintain all required clearances to other equipment.

E. Do not install piping above electrical equipment such as transformers, panels, motor control centers, etc., in other rooms.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back-to-back or side-by-side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees.

J. Use standard pipe increasers and reducers if pipes of different sizes are connected. Do not use bushings. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2% downward in direction of flow for piping NPS 3 and smaller; 1% minimum downward in direction of flow for piping NPS 4 and larger unless noted otherwise.

2. Horizontal Sanitary Drainage Piping: 1/4 inch per foot, 2% downward in direction of flow unless noted otherwise.

3. Vent Piping: 1/8 inch per foot, 1% down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's Cast Iron Soil Pipe and Fittings Handbook, Chapter IV, Installation of Cast Iron Soil Pipe and Fittings.

N. Install aboveground copper tubing according to CDA's Copper Tube Handbook.

O. Install stainless-steel piping in accordance with the manufacturer's written instructions.

P. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Specification Section 22 13 19, Sanitary Waste Piping Specialties.

2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Specification Section 22 13 19, Sanitary Waste Piping Specialties.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by Authorities Having Jurisdiction (AHJ).

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Specification Section 22 05 17, Sleeves and Sleeve Seals for Plumbing Piping.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Specification Section 22 05 17, Sleeves and Sleeve Seals for Plumbing Piping.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Specification Section 22 05 18, Escutcheons for Plumbing Piping.

3.2 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's Cast Iron Soil Pipe and Fittings Handbook for hubless-piping coupling joints.

1. In corrosive applications such as: grease waste; dialysis treatment waste; bar, liquor, or soda waste; food processing waste; healthcare waste; or where noted on the drawings, cover cut ends with epoxy tape to cover exposed cast iron per the pipe manufacturer's written instructions.

B. Join copper tube and fittings with soldered joints according to ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.

C. Join hub-and-spigot, stainless-steel soil piping with gasket joints according to the manufacturer's written instructions and the following:

1. Make all cuts square.

2. Remove burrs.

3. Confirm gasket is in place and not damaged before making joints.

4. Apply lubricant as recommended by the manufacturer.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.

2. In Drainage Piping: Non-pressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Specification Section 22 05 29, Hangers and Supports for Plumbing Piping and Equipment.

1. Install carbon-steel pipe hangers for horizontal piping in non-corrosive environments.

2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.

3. Install carbon-steel pipe support clamps for vertical piping in non-corrosive environments.

4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

5. Vertical Piping: MSS Type 8 or Type 42, clamps.

6. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.

7. Multiple, Straight, Horizontal Piping Runs: Trapeze hangers with pipe clamps.

8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support each section of horizontal piping and tubing within 12 inches of each fitting, valve and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

	Maximum Horizontal Spacing	Minimum Rod Diameter
NPS 1-1/2 & NPS 2	60 inches	3/8-inch rod
NPS 3	60 inches	1/2-inch rod
NPS 4 & NPS 5	60 inches	5/8-inch rod
NPS 6 & NPS 8	60 inches	3/4-inch rod

Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

	Maximum Horizontal Spacing	Minimum Rod Diameter
NPS 1-1/4	72 inches	3/8-inch rod
NPS 1-1/2 & NPS 2	96 inches	3/8-inch rod
NPS 2-1/2	108 inches	1/2-inch rod
NPS 3 & NPS 5	10 feet	1/2-inch rod
NPS 6	10 feet	5/8-inch rod
NPS 8	10 feet	3/4-inch rod

H. Install supports for vertical copper tubing every 10 feet.

I. Install hangers for stainless-steel soil piping with the following maximum horizontal spacing and minimum rod diameters:

	Maximum Horizontal Spacing	Minimum Rod Diameter
NPS 1-1/2 & NPS 4	120 inches	3/8-inch rod
NPS 5 & NPS 8	120 inches	1/2-inch rod
NPS 10 & NPS 12	120 inches	5/8-inch rod

J. Install supports for vertical stainless-steel piping every 10 feet.

K. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

	Maximum Span	Minimum Rod Size
NPS 3/4	7 feet	1/4 inch
NPS 1	7 feet	1/4 inch
NPS 1-1/2	9 feet	3/8 inch
NPS 2	10 feet	3/8 inch

	Maximum Span	Minimum Rod Size
NPS 2-1/2	11 feet	3/8 inch
NPS 3	12 feet	3/8 inch
NPS 4	12 feet	1/2 inch
NPS 6	12 feet	1/2 inch
NPS 8	12 feet	5/8 inch

L. Install supports for vertical steel piping every 10 feet.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by the AHJ.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Comply with requirements for cleanouts and drains specified in Specification Section 22 13 19, Sanitary Waste Piping Specialties.

6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Specification Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.7 FIELD QUALITY CONTROL

A. During installation, notify the AHJ at least 24 hours before inspection must be made. Perform tests specified below in the presence of the AHJ.

1. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by the AHJ to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If the AHJ finds that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by the AHJ.

D. Test sanitary drainage and vent piping according to the procedures of the AHJ or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. Water level must not drop for 4 hours. Inspect joints for leaks and make all necessary repairs.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection but no less than 30 minutes. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground soil and waste piping NPS 4 and smaller shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 4-band hubless-piping couplings; and coupled joints.

2. Copper DWV tube, copper drainage fittings, and soldered joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

C. Aboveground vent piping NPS 4 and smaller shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; standard-duty hubless-piping couplings; and coupled joints.

2. Copper DWV tube, copper drainage fittings, and soldered joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

D. Aboveground soil and waste piping NPS 5 and larger shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 6-band hubless-piping couplings; and coupled joints.

2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

E. Aboveground vent piping NPS 5 and larger shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; standard-duty hubless-piping couplings; and coupled joints.

2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

F. Underground soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 4-band hubless-piping couplings; and coupled joints.

2. Stainless-steel soil pipe and fittings; gaskets; and gasketed joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

G. Underground soil, waste, and vent piping NPS 5 and larger shall be any of the following:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 6-band hubless-piping couplings; and coupled joints.

2. Stainless-steel soil pipe and fittings; gaskets; and gasketed joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

H. Aboveground soil and waste piping serving a kitchen or area where drain water temperatures will reach 140°F or above shall be:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 4-band hubless-piping couplings; and coupled joints.

2. Extend to grease interceptor or 50 feet beyond boundary of kitchen or area.

I. Underground soil and waste piping serving a kitchen or area where drain water temperatures will reach 140°F or above shall be:

1. Epoxy-coated, hubless, cast-iron soil pipe and fittings; heavy-duty, 4-band hubless-piping couplings; and coupled joints.

2. Stainless-steel soil pipe and fittings; gaskets; and gasketed joints.

3. Extend to grease interceptor or 50 feet beyond boundary of kitchen or area.

END OF SECTION

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SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following sanitary drainage piping specialties:

1. Cleanouts.

2. Floor drains.

3. Floor sinks.

4. Trench drains.

5. Roof flashing assemblies.

6. Miscellaneous sanitary drainage piping specialties.

7. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer, model number, materials of construction, and options and accessories.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Jay R. Smith Manufacturing Co.

2. Josam Company; Josam Division.

3. Mifab, Inc.

4. Sioux Chief Manufacturing Company, Inc.

5. Watts Drainage Products Inc.

6. Zurn Plumbing Products Group.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

2. Size: Same as connected drainage piping.

3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.

4. Closure: Countersunk, plastic plug, except provide brass plug in return air plenums.

5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.

2. Size: Same as connected branch.

3. Type: Adjustable housing.

4. Body or Ferrule: Cast iron.

5. Clamping Device: Not required.

6. Outlet Connection: Spigot.

7. Closure: Plastic plug.

8. Adjustable Housing Material: Cast iron with threads.

9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy

10. Frame and Cover Shape: Round in concrete floors, square in tiled floors.

11. Top Loading Classification: Heavy Duty.

12. Riser: ASTM A74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.

2. Size: Same as connected drainage piping.

3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.

4. Closure: Countersunk, plastic plug.

5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Standard: ASME A112.6.3.

2. Pattern: Floor drain.

3. Body Material: Gray iron.

4. Seepage Flange: Required for slabs above grade.

5. Anchor Flange: Required for slabs on grade.

6. Clamping Device: Required, where floor has waterproofing membrane.

7. Outlet: Bottom or Side as required.

8. Backwater Valve: Not required.

9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel when located in equipment rooms.

10. Sediment Bucket: Slotted type when located in equipment rooms.

11. Top or Strainer Material: Gray iron in unfinished floors, Nickel bronze in finished floors.

12. Top of Body and Strainer Finish: Nickel bronze in unfinished floors, polished bronze in finished floors.

13. Top Shape: Round in concrete floors, Square in tiled floors.

14. Top Loading Classification: Extra heavy-duty in areas with vehicle traffic, heavy duty in equipment rooms, light duty in finished areas.

15. Funnel: Required, where indicated on drawings.

16. Trap Material: Cast iron or copper to match adjacent piping.

17. Trap Pattern: Standard P-trap unless noted otherwise.

18. Trap Features: Trap-seal primer valve connection and cleanout where trap primers are indicated.

B. Stainless-Steel Floor Drains for use with Stainless-Steel Waste Piping:

1. Pattern: Floor drain.

2. Body Material: Type 304 stainless steel.

3. Seepage Flange: Required for slabs above grade.

4. Anchor Flange: Required for slabs on grade.

5. Clamping Device: Required, where floor has waterproofing membrane.

6. Outlet: Bottom or Side as required.

7. Backwater Valve: Not required.

8. Top or Strainer Material: Type 304 stainless steel.

9. Top of Body and Strainer Finish: Type 304 stainless steel.

10. Top Shape: Round in concrete floors, Square in tiled floors.

11. Top Loading Classification: Extra heavy-duty in areas with vehicle traffic, heavy duty in equipment rooms, light duty in finished areas.

12. Funnel: Required, where indicated on drawings.

13. Trap Material: Type 304 stainless steel to match adjacent piping.

14. Trap Pattern: Standard P-trap unless noted otherwise.

15. Trap Features: Trap-seal primer valve drain connection and cleanout where trap primers are indicated.

2.4 FLOOR SINKS

A. Cast-Iron Floor Sinks:

1. Standard: ASME A48-83.

2. Pattern: Floor sink.

3. Body Material: Gray iron.

4. Seepage Flange: Required for slabs above grade.

5. Anchor Flange: Required for slabs on grade.

6. Clamping Device: Required, where floor has waterproofing membrane.

7. Outlet: Bottom.

8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

9. Sediment Bucket: Aluminum slotted type when located in kitchen area

10. Dome Strainer: Anti-splash with acid-resistant enamel coating for non-kitchen areas.

11. Top or Grate Material: Acid-resistant enamel, fully coated.

12. Grate: Full, three-quarters, or half as required for application.

13. Top Shape and Size: Square, 12" x 12" unless noted otherwise.

14. Basin Depth: 8 inches unless noted otherwise.

15. Funnel: Required, where indicated on drawings.

16. Trap Material: Cast iron or copper to match adjacent piping.

17. Trap Pattern: Standard P-trap unless noted otherwise.

18. Trap Features: Trap-seal primer valve drain connection where trap primers are indicated.

B. Stainless-Steel Floor Sinks for use with Stainless-Steel Waste Piping:

1. Pattern: Floor sink.

2. Body Material: Stainless steel.

3. Seepage Flange: Required for slabs above grade.

4. Anchor Flange: Required for slabs on grade.

5. Clamping Device: Required, where floor has waterproofing membrane.

6. Outlet: Bottom.

7. Sediment Bucket: Stainless-steel slotted type when located in kitchen area.

8. Dome Strainer: Anti-splash for non-kitchen areas.

9. Top or Grate Material: Type 304 stainless steel.

10. Grate: Full, three-quarters, or half as required for application.

11. Top Shape and Size: Square, 12" x 12" unless noted otherwise.

12. Basin Depth: Minimum of 8 inches unless noted otherwise.

13. Funnel: Required, where indicated on drawings.

14. Trap Material: Type 304 stainless steel to match adjacent piping.

15. Trap Pattern: Standard P-trap unless noted otherwise.

16. Trap Features: Trap-seal primer valve drain connection where trap primers are indicated.

2.5 TRENCH DRAINS

A. Shower Entry Trench Drains:

1. Standard: ADA Compliance.

2. Body Material: Polypropylene.

3. Flange: Not required.

4. Clamping Device: Molded clips to accommodate vertical rebar for positioning.

5. Outlet: Bottom.

6. Grate Material: Stainless steel, slotted.

7. Dimensions of Frame and Grate: 36-42" long x 6" wide or as noted on drawings.

8. Top-Loading Classification: Light Duty.

2.6 ROOF FLASHING ASSEMBLIES

A. Description: Manufactured assembly made of 4.0-lb./sq.ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564, rubber gaskets.

2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch minimum water seal.

b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Barrier-Type Trap Sealer:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IPS Corporation.

b. Jay R. Smith Manufacturing Co.

c. MIFAB, Inc.

d. Precision Plumbing Products.

e. Sioux Chief Manufacturing Company, Inc.

f. RectorSeal.

2. Description: Device that is installed at the drain body outlet to prevent sewer gases from escaping the waste piping into the building while allowing water and other materials to flow into the waste system. User replaceable from above.

3. Materials: Flexible elastomeric material such as PVC, EPDM, etc.

4. Conformance: ASSE 1072 or other standard acceptable to the Authority Having Jurisdiction.

E. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

F. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

G. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb./sq.ft., 0.0625-inch thickness.

2. Vent Pipe Flashing: 3.0-lb./sq.ft., 0.0469-inch thickness.

3. Burning: 6-lb./sq.ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install a two-way cleanout at the waste piping exit of the building.

E. Extend surface cleanouts up to grade.

1. For cleanouts terminating in paved or other finished surfaces, install cleanout deck plate with top flush with finished surface.

2. For cleanouts terminating in landscaping or other unfinished surface, install cleanout deck plate flush with top of (and centered in) minimum 12" x 16" x 4" concrete pad. Pad to be flush with adjacent surfaces.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1% slope, but not less than 1/4-inch total depression.

b. Radius, 30 to 60 Inches: Equivalent to 1% slope.

c. Radius, 60 Inches or Larger: Equivalent to 1% slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install floor sinks where indicated on drawings. Set grates of sinks flush with finished floor, unless otherwise indicated.

1. Position floor sinks for easy access and maintenance.

2. Install floor-sink flashing collar or flange so no leakage occurs between sink and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

3. Install individual traps for floor sinks connected to sanitary building drain, unless otherwise indicated.

H. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

I. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

K. Assemble open drain fittings and install with top of hub 2 inches above floor.

L. Install deep-seal traps on floor drains and other waste outlets where indicated.

M. Install barrier-type trap sealers on all floor sinks and floor drains in accordance with the manufacturer’s installation instructions unless indicated otherwise on the drawings.

N. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

O. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

P. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

Q. Install vent caps on each vent pipe passing through roof.

R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb./sq.ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb./sq.ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 specifications.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 22 14 29

SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Submersible sump pumps.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions.

3. Equipment dimensions.

4. Required clearances.

5. Electrical Data:

a. Motor horsepower.

b. Voltage/Phase/Hz.

c. Full load ampacity, minimum circuit ampacity and maximum overcurrent protection device requirements.

d. Electrical service point(s) of connection.

e. AIC rating of the equipment.

6. Materials of construction.

7. Accessories and options.

8. Controls.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bell & Gossett Domestic Pump.

b. Grundfos Pumps Corp.

c. Little Giant Pump Co.

d. Weil Pump Company, Inc.

e. Weinman Division.

f. Zoeller Company.

2. Description: Factory-assembled and -tested sump-pump unit.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Stainless steel, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

5. Impeller: Stainless steel.

6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.

7. Seal: Mechanical.

8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and 3-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

9. Controls:

a. Switch Type: Unit mounted Mechanical-float or pressure type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.

b. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float or pressure switch matching control and electric bell; 120 VAC, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.

b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.

2) Alarm status.

B. Submersible, Quick-Disconnect, Double-Seal Sewage Pumps:

1. Description: Factory-assembled and -tested sump-pump unit with guide-rail supports.

2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, simplex or duplex configuration as indicated on the drawings, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.

3. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.

4. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron or ASTM A532/A532M, abrasion-resistant cast iron or ASTM B584, cast bronze or stainless steel, closed or semi-open design keyed and secured to shaft.

5. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.

6. Seals: Mechanical.

7. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.

8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and 3-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

9. Controls:

a. Switch Type: Unit mounted mechanical-float or pressure type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.

b. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float or pressure switch matching control and electric bell; 120 VAC, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.

b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of each pump.

2) Alarm status.

11. Guide-Rail Supports:

a. Standard: SWPA's Submersible Sewage Pumping Systems (SWPA) Handbook.

b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.

c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.

d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.

e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.

f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.

g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A53/A53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Specification Section 22 05 13, Common Motor Requirements for Plumbing Equipment.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 sections.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Division 31 specifications.

3.2 INSTALLATION

A. Pump Installation Standard: Comply with HI 1.4 for installation of sump pumps.

B. Secure basins with concrete donut or other method to securely anchor basin in ground.

C. Assemble piping to allow for maintenance and replacement of components.

END OF SECTION

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SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Commercial, electric, storage, domestic-water heaters.

2. Domestic-water heater accessories.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions.

3. Equipment dimensions.

4. Required clearances.

5. Electrical Data:

a. Voltage/Phase/Hz.

b. Electrical service point(s) of connection.

6. Materials of construction.

7. Accessories and options.

8. Controls.

B. Domestic-Water Heater Labeling: Certified and labeled by the testing agency acceptable to the Authorities Having Jurisdiction.

C. Operation and maintenance data.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/ IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, Drinking Water System Components - Health Effects.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: 3 years.

2) Controls and Other Components: 3 years.

b. Compression Tanks: 5 years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A.O. Smith Corporation.

2. Bradford White Corporation.

3. Lochinvar Corporation.

4. PVI Industries, LLC.

5. Rheem Manufacturing Company.

B. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Standard: UL 174 or UL 1453.

2. Storage-Tank Construction: Steel vertical arrangement. Comply with ASME-code for tanks larger than 120 gallons or heater inputs larger than 12 kW.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Pressure Rating: 150 psig.

c. Interior Finish: Glass, enamel or similar baked-on finish complying with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant complying with ASSE 1005.

d. Insulation: Comply with ASHRAE/IESNA 90.1.

e. Jacket: Steel with enameled finish.

f. Heating Elements: Electric, screw-in or bolt-on immersion type wired for simultaneous operation unless noted otherwise.

g. Temperature Control: Adjustable thermostat.

h. Safety Controls: High-temperature-limit cutoff devices or systems.

i. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

C. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm.

2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 125 psig.

b. Air Precharge Pressure: 12 psig.

D. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

E. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

F. Heat-Trap Fittings: ASHRAE 90.2.

G. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of 1.5 times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 specifications for retesting and reinspecting requirements and for requirements for correcting the work.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters in drain pan on strut stand to support bottom of heater minimum 6 inches above finished floor. Comply with requirements for supports specified in Hangers and Supports for Plumbing Piping and Equipment.

1. Exception: Omit strut stands for commercial, electric, domestic-water heaters if installation on bracket, suspended platform, concrete pad, or directly on floor is indicated.

2. Maintain manufacturer’s recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.

4. For supported equipment, install epoxy-coated anchor bolts that anchor stand to structural concrete floor.

5. For units installed on concrete bases:

   a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

   b. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

   c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

   d. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Specification Section 22 05 23, General Duty Valves for Plumbing Piping.

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor sink, mop sink, or to exterior with downturned elbow at 6 inches above grade.

D. Install water-heater drain-pan drain piping to nearest floor drain, floor sink or mop sink. Coordinate mounting height of water heater to allow for sloping of drain piping from drain pan to receptor.

E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Specification Section 22 05 19, Meters and Gages for Plumbing Piping.

F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps. Piping-type heat traps shall consist of a minimum 12-inch vertical drop or 360-degree loop of piping.

G. Flush and fill electric, domestic-water heaters with water. Vent trapped air from water heater.

H. Charge domestic-water compression tanks with air. Set pressure equal to incoming water pressure. Set pressure with one hot water tap flowing.

3.2 CONNECTIONS

A. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Specification Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 specifications for retesting and reinspecting requirements and for requirements for correcting the work.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes standard plumbing fixtures and accessories.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

F. Solid Surface: Non-porous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer, model number, options and accessories. Label each data submittal with fixture designation shown on drawings.

B. Warranty information.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction, and marked for intended use.

B. Regulatory Requirements:

1. Comply with requirements in ICC A117.1, Accessible and Usable Buildings and Facilities; Public Law 90-480, Architectural Barriers Act; and Public Law 101-336, Americans with Disabilities Act; for plumbing fixtures for people with disabilities.

2. Comply with requirements in Public Law 102-486, Energy Policy Act, about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, Drinking Water System Components--Health Effects, for fixture materials that will be in contact with potable water.

D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible and of the same manufacturer for all like items.

E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.

2. Plastic Laundry Trays: ANSI Z124.6.

3. Plastic Shower Enclosures: ANSI Z124.2.

4. Plastic Sinks: ANSI Z124.6.

5. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.

6. Slip-Resistant Bathing Surfaces: ASTM F462.

7. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.

8. Stainless-Steel Residential Sinks: ASME A112.19.3.

9. Vitreous-China Fixtures: ASME A112.19.2M.

10. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

11. Water-Closet, Flushometer Tank Trim: ASSE 1037.

F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.

3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.

4. Faucets: ASME A112.18.1.

5. Hose-Connection Vacuum Breakers: ASSE 1011.

6. Hose-Coupling Threads: ASME B1.20.7.

7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.

8. NSF Potable-Water Materials: NSF 61.

9. Pipe Threads: ASME B1.20.1.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

11. Supply Fittings: ASME A112.18.1.

12. Brass Waste Fittings: ASME A112.18.2.

13. Components shall be lead-free as defined by the Safe Drinking Water Act Amendments of 1986 and the Lead Contamination Control Act of 1988.

G. Comply with the following applicable standards and other requirements specified for bathtub/shower and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.

2. Combination, Pressure-Equalizing- and Thermostatic-Control Anti-Scald Faucets: ASSE 1070.

3. Faucets: ASME A112.18.1.

4. Hand-Held Shower Backflow Prevention Devices: ASSE 1014.

5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F445.

6. Hose-Coupling Threads: ASME B1.20.7.

7. Manual-Control Anti-Scald Faucets: ASTM F444.

8. Pipe Threads: ASME B1.20.1.

9. Pressure-Equalizing-Control Anti-Scald Faucets: ASTM F444 and ASSE 1070.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

11. Thermostatic-Control Anti-Scald Faucets: ASTM F444 and ASSE 1070.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.

2. Brass and Copper Supplies: ASME A112.18.1.

3. Dishwasher Air-Gap Fittings: ASSE 1021.

4. Manual-Operation Flushometers: ASSE 1037.

5. Plastic Tubular Fittings: ASTM F409.

6. Brass Waste Fittings: ASME A112.18.2.

7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.

2. Dishwasher Air-Gap Fittings: ASSE 1021.

3. Flexible Water Connectors: ASME A112.18.6.

4. Grab Bars: ASTM F446.

5. Hose-Coupling Threads: ASME B1.20.7.

6. Hot-Water Dispensers: ASSE 1023 and UL 499.

7. Off-Floor Fixture Supports: ASME A112.6.1M.

8. Pipe Threads: ASME B1.20.1.

9. Plastic Toilet Seats: ANSI Z124.5.

10. Supply & Drain Protective Shielding Guards: ICC A117.1, ASTM E84-07.

PART 2 - PRODUCTS

2.1 LAVATORY AND SINK FAUCETS

A. Standard Lavatory and Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

a. American Standard Brands.

b. Bradley Corporation.

c. CHG Component Hardware Group.

d. Chicago Faucets.

e. Delany Products.

f. Delta Commercial Faucet Company.

g. Elkay Manufacturing Co.

h. Grohe America, Inc.

i. Just Manufacturing Company.

j. Kohler Co.

k. Moen, Inc.

l. Powers; a Watts Water Technologies Co.

m. Speakman Company.

n. T & S Brass and Bronze Works, Inc.

o. Zurn Plumbing Products Group; Commercial Brass Operation.

B. Metering Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

a. American Standard Brands.

b. CHG Component Hardware Group.

c. Chicago Faucets.

d. Moen, Inc.

e. Powers; a Watts Water Technologies Co.

f. Sloan Valve Company.

g. Symmons Industries, Inc.

h. Zurn Plumbing Products Group; Commercial Brass Operation.

2.2 BATHTUB AND SHOWER FAUCETS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Bradley Corp.

3. Chicago Faucets.

4. Leonard Valve Co.

5. Moen, Inc.

6. Powers; a Watts Water Technologies Co.

7. Symmons Industries, Inc.

8. Zurn Plumbing Products Group, Commercial Brass Operation.

2.3 FLUSH VALVES FOR URINALS AND WATER CLOSETS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Delany Products.

3. Moen, Inc.

4. Sloan Valve Company.

5. TOTO USA, Inc.

6. Zurn Plumbing Products Group; Commercial Brass Operation.

2.4 TOILET SEATS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by the following:

1. American Standard Brands.

2. Bemis Manufacturing Company.

3. Church Seats.

4. Kohler Co.

5. Olsonite Corp.

6. Sanderson Plumbing Products, Inc.; Beneke Division.

7. Sperzel.

8. Zurn Plumbing Products Group; Commercial Brass Operation.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGuire Manufacturing Co., Inc.

b. Plumberex Specialty Products Inc.

c. TRUEBRO, Inc.

d. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water, cold-water, and tempered-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements. Product shall meet ADA and ICC/ANSI A117.1. Insulation material shall comply with ASTM E84-07/UL 723 Class A and shall be listed and meet UPC/IAPMO.

2.6 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Jay R. Smith Manufacturing Co.

2. MIFAB Manufacturing Inc.

3. Sun Drainage Products.

4. Tyler Pipe; Wade Division.

5. Watts Drainage Products; a Division of Watts Water Technologies.

6. Zurn Plumbing Products Group; Specification Drainage Operation.

2.7 DISHWASHER AIR-GAP FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dearborn Brass; a Division of Moen, Inc.

2. Geberit Manufacturing, Inc.

3. Sioux Chief Manufacturing Company, Inc.

4. Watts Brass & Tubular; a Division of Watts Water Technologies.

2.8 DISPOSERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. In-Sink-Erator; a Division of Emerson Electric Co.

2. KitchenAid.

3. Maytag Co.

2.9 HOT-WATER DISPENSERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. Anaheim Manufacturing, Inc.; a Subsidiary of Western Industries, Inc.

2. Franke Consumer Products, Inc.; Kitchen Systems Division.

3. In-Sink-Erator; a Division of Emerson Electric Co.

4. Just Manufacturing Company.

B. Description: Gooseneck spout with lever-handle, twist-knob or pushbutton, flow control, household-type dispenser with instant on-off control; insulated, corrosion-resistant-metal storage tank that is open to atmosphere; electric heating element; chrome-plated faucet or spout; removable strainer; thermostat control for water temperature up to 190°F; and thermal-overload protection.

1. Storage Tank Capacity: 0.5 gallon.

2. Heating Element: 750 W minimum, 115 VAC.

2.10 LAVATORIES, WATER CLOSETS, AND URINALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Caroma.

3. Kohler Co.

4. Waterless Company, Inc.

5. Zurn Plumbing Products Group.

2.11 BATHTUBS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Kohler Co.

2.12 INDIVIDUAL SHOWERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Kohler Co.

2.13 STAINLESS-STEEL SINKS

A. Kitchen Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

a. American Standard Brands.

b. Elkay Manufacturing Company.

c. Just Manufacturing Company.

d. Moen, Inc.

2.14 SERVICE SINKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Companies, Inc.

2. Fiat Products.

3. Just Manufacturing Company.

4. Kohler Co.

2.15 MOP SINKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. American Standard Brands.

2. Fiat Products.

3. Florestone Inc.

4. Just Manufacturing Company.

5. Zurn Plumbing Products Group.

2.16 LAUNDRY TRAYS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. Fiat Products.

2. Florestone Products Co., Inc.

3. Gerber Plumbing Fixtures LLC.

4. Just Manufacturing Company.

5. Zurn Plumbing Products Group; Light Commercial Operation.

2.17 WASH FOUNTAINS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. Bradley Corp.

2. Intersan Manufacturing Co.

3. Willoughby Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturer's written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.

2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flush valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns. If faucets are not available with required rates and patterns, include adapters as required.

N. Install gooseneck faucets to spill into sink or lavatory basin.

O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

S. Install disposer in outlet of each sink indicated to have disposer.

T. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Connect inlet hose to dishwasher and outlet hose to disposer.

U. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink as indicated.

V. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Specification Section 22 05 18, Escutcheons for Plumbing Piping.

W. Set bathtubs and showers in leveling bed of cement grout. Grout is specified in Specification Section 22 05 00, General Provisions.

X. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 specifications.

Y. Install protective shielding guards per the manufacturer’s written instructions to cover all exposed piping and valves below handicap accessible sinks and lavatories.

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Flush and replace all lavatory and sink aerators, and shower heads after water systems are pressurized, cleaned, and sanitized.

E. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

F. Set temperature limiting devices to a maximum of 120°F unless noted otherwise on the drawings.

G. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION

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SECTION 22 47 00

DRINKING FOUNTAINS & WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes drinking fountains and water coolers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer, model number, options, and accessories.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction (AHJ), and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, Accessible and Usable Buildings and Facilities; Public Law 90-480, Architectural Barriers Act; and Public Law 101-336, Americans with Disabilities Act; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, Drinking Water System Components--Health Effects, for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's Directory of Certified Drinking Water Coolers for style classifications.

E. ARI Standard: Comply with ARI 1010, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers, for water coolers and with ARI's Directory of Certified Drinking Water Coolers for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, Designation and Safety Classification of Refrigerants for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS AND WATER COOLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1. Acorn Engineering Company.

2. Elkay Manufacturing.

3. Halsey Taylor.

4. Oasis Corporation.

5. Sunroc Corp.

2.2 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Jay R. Smith Manufacturing Co.

2. Josam Co.

3. MIFAB Manufacturing, Inc.

4. Tyler Pipe; Wade Division.

5. Watts Drainage Products Inc.; a Division of Watts Industries, Inc.

6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.

2. Type II: Bi-level, hanger-type carrier with three vertical uprights.

3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Set freestanding and pedestal drinking fountains on floor or concrete pad.

C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by the AHJ.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valve unless otherwise indicated. Install valves in locations where they can be easily reached for operation. Valves are specified in Specification Section 22 05 23, General Duty Valves for Plumbing Piping.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Specification Section 22 05 18, Escutcheons for Plumbing Piping.

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 specifications.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.

2. Report test results in writing.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

END OF SECTION

Edition 0308-1115

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DIVISION 23

HEATING, VENTILATING & AIR CONDITIONING

END OF INDEX

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. The Contract Documents do not specify exact installation means and methods. Installation means and methods are the responsibility of the Contractor. No instruction or statement made on the Contract Documents shall be interpreted to shift this responsibility away from the Contractor.

1.2 DEFINITIONS

A. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unconditioned shelters.

B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in duct shafts, and in utility chases.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and mechanical yards.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include finished spaces and mechanical equipment rooms.

E. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unconditioned spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and utility tunnels.

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and project conditions, and pay all costs necessary to perform the work.

1.4 MECHANICAL SUBCONTRACTOR

A. The Mechanical Subcontractor shall have a minimum of 2 years of documented experience on projects of similar scope and complexity.

B. The Mechanical Subcontractor shall hold a current contracting license in the State of Arizona as a mechanical contractor.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, disposal, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01 specifications.

C. Inspections: All work must be inspected and approved by the local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01 specifications.

1.6 DRAWINGS AND SPECIFICATIONS

A. Refer to Division 01 specifications for additional information on submittals and shop drawings.

B. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be contract documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

B. Product Information Sheets: Provide project-specific manufacturer's literature which includes the information required by the Product Data paragraph of the applicable specification section. Where Product Information Sheets show multiple models or options, clearly mark the model and options to be provided.

1. Identify options requiring selection by the Engineer.

C. Assembly: Assemble all required submittal information for each specification section and submit in Portable Document Format (PDF).

1. Assemble PDF submittals in one PDF file for this division. Separate and order sections within the file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.

2. Partial submittals and submittals that are not project specific will be returned without review. Submittals for Building Automation System may be submitted separately.

D. Identification and Information:

1. Name the PDF file with the project name, division number and sequential submittal number (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2).

2. Provide a cover sheet at the front of each submittal with the following information:

a. Project name.

b. Date.

c. Name of Engineer.

d. Name of Contractor.

e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

a. Name of supplier.

b. Name of manufacturer.

c. Number and title of appropriate specification section.

d. Drawing number and detail references, as appropriate.

e. Other necessary identification.

E. Deviations: Identify deviations from the Contract Documents on submittals and coordinate with all affected systems.

F. Furnished by Others: This project is to provide a complete and functional system. Where material or labor is indicated in the submittal to be provided by Contractor, Subcontractor, or Owner clearly indicated who is providing those items and include information to indicate proper coordination.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current, Material Safety Data Sheets (MSDS), for all hazardous materials that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of 1 week prior to the delivery of any hazardous materials to the site.

2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the Contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information (RFI):

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.

2. A properly prepared request for information shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specification in need of clarification and the nature of the clarification requested.

a. Drawings shall be identified by drawing number and location on the drawing sheet.

b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based upon the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the Contract Documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner who may deduct an equal amount from the monies due the Contractor.

1.10 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings.

1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Include all equipment, and underground and overhead piping.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Include dimensions both horizontally and vertically to permanent points of reference, accurate within 6 inches. Include descriptors such as "below slab," "above ceiling," etc.

c. Record data daily or as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.

2. Mark the As-Built Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of As-Built Drawings.

3. Mark As-Built Drawings with erasable, red colored pencil, or in a digital PDF format using an editor program such as Bluebeam, Adobe Acrobat Professional, or similar. Use other colors to distinguish between changes for different categories of the work at the same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

5. Update the As-Built Drawings weekly or daily as appropriate for the project size.

B. Format: Identify and date each As-Built Drawing; include the designation "PROJECT AS-BUILT DRAWING" in a prominent location.

1. Organize newly-prepared As-Built Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification, as follows:

a. Project name.

b. Date.

c. Designation "PROJECT AS-BUILT DRAWINGS."

d. Name of Engineer.

e. Name of Contractor.

3. Remove or obscure the Engineer’s seal and signature from As-Built Drawings.

1.11 QUALITY ASSURANCE

A. Welding:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

1.12 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete Equipment, Operation and Maintenance Manual for all equipment supplied under Division 23.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to Substantial Completion for review and comment.

2. Submit the final version of the manual not more than 4 weeks after Substantial Completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF Electronic Files: Assemble each manual into a single master directory with sub-directories for the individual PDF files for each system and piece of equipment. Provide a table of contents file with hyperlinks to each of the individual PDF files within the sub-directories. Submit on digital media acceptable to the Engineer.

a. Name each directory, sub-directory, and document file with applicable item name.

b. Enable reviewer comments on draft submittals.

2. Paper Copies: Assemble paper copies in 3-ring binders. Separate and order systems and equipment within each binder. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab. Enclose title pages and directories in clear plastic sleeves.

D. Provide Operation and Maintenance Manuals for all systems, subsystems, and equipment that require operation and regular maintenance, or have replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturer’s maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this section, include operation and maintenance data required in individual specification sections.

F. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of installer or supplier and maintenance service agent, and cross-reference specification section number and title in Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Approved submittals.

3. Include the following if not shown on approved submittals:

a. Product name and model number. Use designations for products indicated on Contract Documents.

b. Manufacturer's name.

c. Equipment identification with serial number of each component.

d. Equipment function.

e. Operating characteristics.

f. Limiting conditions.

g. Performance curves.

h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures. Including precautions against improper use.

10. Operating logs.

I. Wiring Diagrams: Diagram of factory-installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Piped Systems: Diagram piping as installed and identify color-coding where required for identification. Include valve locations and designations.

L. Manufacturer's Maintenance Documentation: Manufacturer's maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

M. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

N. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

O. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

P. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

Q. Licenses: Include copies of any licenses with requirements including inspection and renewal dates.

R. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

S. Test and Balance Report: Include a final approved copy of the Test and Balance Report.

1.13 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. The Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of the same type or classification by the same manufacturer.

1.14 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 specifications for description of material and equipment for prior approvals and substitutions.

1.15 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. Refer to Division 01 specifications for additional requirements.

B. Cooperative work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 23 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts and anchor bolts for work under sections in Division 23.

3. Sealing of penetrations through fire and smoke barriers caused by work installed as part of Division 23.

1.16 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and legally disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused piping, ductwork, controls and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, ductwork, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining mechanical and control service to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Architect and Owner.

D. Disconnect, demolish, and remove mechanical systems, equipment, and components that are indicated to be removed.

1. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with the same or compatible piping material. Patch insulation, as required, to match adjacent areas.

2. Piping to be Abandoned In Place: Drain piping and cap or plug piping with the same or compatible piping material.

3. Ducts to be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with the same or compatible ductwork material. Patch insulation, as required, to match adjacent areas.

4. Ducts to be Abandoned In Place: Cap ducts with the same or compatible ductwork material.

5. Equipment to be Removed: Disconnect and cap services and remove equipment.

6. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.

E. Continuity of Services in Existing Building: The Contractor shall permanently reroute existing mechanical and control services or provide temporary connection as required to maintain service to existing equipment and systems in building which are to remain in service.

F. Rerouting and Relocation of Existing Mechanical Equipment and Services in Existing Building:

1. General: The Contractor shall reroute, relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.

2. Existing Piping and Ductwork: Where applicable, existing material may be reused in their original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are modified, reused or are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.17 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner’s establishment and such facilities shall be kept clear of materials or equipment. Refer to Division 01 specifications for additional requirements.

B. Furnish and maintain from the beginning to the completion of all work all lawful and necessary security, guards, railings, fences, canopies, lights, fire protection, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.18 WARRANTY

A. Provide a written warranty that all material, equipment, installation and workmanship for all sections under Division 23 are to be free from defects of material and workmanship for 2 years from date of final acceptance as outlined in Division 01 specifications. Equipment warranties shall be a minimum of 2 years from date of Substantial Completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period. The warranty shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

1.19 MECHANICAL WIRING

A. Provide all temperature control wiring, interlock wiring, and equipment control wiring for the equipment that is to be provided under Division 23 unless wiring is specifically shown on the electrical drawings.

B. The following schedule is intended to summarize the division of work and material responsibilities between the Mechanical Contractor, Controls Contractor and Electrical Contractor.

Item	Furn. By	Set By	Power Wiring	Control Wiring
Equipment Motors	MC	MC	EC	--
Motor Control Center	EC	EC	EC	CC
Motor Starters, Controllers, Contactors & Overload Heaters	MC*	EC**	EC	CC
Fused & Non-Fused Disconnect Switches	EC**	EC**	EC	--
Manual Operating Switches, Multi-Speed Switches, Pushbutton Stations & Pilot Lights	CC	CC	CC	CC
Control Relays & Transformers	CC	CC	CC	CC
Line Voltage Thermostats & Time Switches***	MC	MC	EC	EC
Low-Voltage Thermostats	MC	MC	-	MC
Temperature Control Panels	MC	MC	EC	CC
Smoke Detectors (Duct Mounted)	EC	MC	EC	MC or CC
Motor & Solenoid Valves, Damper Motors, PE & EP Switches	CC	MC	CC	CC
Water Treatment Equipment	MC	MC	EC	CC

MC = Mechanical Contractor
CC = Controls Contractor
EC = Electrical Contractor

*Except where such devices are located in MCCs.

**Unless required by these specifications to be provided as part of a factory- furnished assembly (i.e., fan coils, air handlers, chillers, etc.).

***Motor-drive units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract.

PART 2 - PRODUCTS

2.1 MACHINERY DRIVES

A. Unless otherwise specified in Division 23 equipment sections, use V-belts designed for 150% of capacity for all belt drives. For multiple belt drives, use matched sets, so marked at the factory.

B. On drives with not more than two belts, provide adjustable pitch motor sheaves with the midpoint of the adjustment range equal to that required to achieve the specified fan capacity.

C. On motors with drives with more than two belts, furnish non-adjustable sheaves, providing the specified fan capacity.

2.2 MACHINERY ACCESSORIES

A. Guards: Provide totally enclosed OSHA-type belt guards for all rotating equipment. Design guards to be readily removable for access to belt drives.

PART 3 - EXECUTION

3.1 REFRIGERANT HANDLING AND DOCUMENTATION

A. Refrigerant Handling: Handle, contain and dispose of refrigerant in compliance with local, federal, and EPA regulations and requirements.

B. Documentation: Maintain documentation for all refrigerant brought onto or removed from project location in compliance with local, federal, and EPA regulations and requirements. Submit documentation to the Owner and Architect.

3.2 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Submit one copy of PDF submittals via email, project website or other electronic media.

3.3 AS-BUILT DRAWINGS AND RECORD DOCUMENTS

A. Recording: Post changes and modifications to the As-Built Drawings as they occur; do not wait until the end of the project.

B. Maintenance of As-Built Drawings and Record Documents: Store Record Documents in the field office, apart from the Contract Documents used for construction. Do not use project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project Record Documents for the Engineer’s reference during normal working hours. As-Built Drawings will be reviewed by the Architect, Owner, and Engineer at each pay request review.

C. Submit As-Built Drawings to the Architect at completion of the project.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare operation and maintenance manuals as directed.

B. Submit a preliminary electronic copy of the operation and maintenance manual to the Engineer for review.

C. Make any corrections noted from the Engineer's review upon receipt of comments and resubmit as required.

D. Submit the final, corrected operation and maintenance manual in both paper and electronic format to the Architect.

3.5 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best sequence and installation methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.6 CUTTING AND PATCHING

A. Cut work and patch per Division 01 specifications as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary design and installation of steel to support equipment, ducts and pipes between structural steel unless shown on the structural drawings.

3.7 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.8 EXCAVATION AND BACKFILL

A. Perform all necessary excavation, shoring and backfilling required for the proper laying of all pipes, ducts, and conduits inside the building and premises, and outside as may be necessary. Remove all excess excavated materials from the site or dispose of onsite as directed by the General Contractor.

B. Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms not less than 18 inches wide but no wider than necessary to provide ample work room. Excavate to provide continuous granular bedding as indicated. Do not cut any trench near or under footings without first consulting the Architect. Comply with OSHA requirements.

C. Provide not less than 4 inches of granular material as duct or pipe bedding. Grade and compact trench bedding accurately prior to laying duct or pipe in trench to provide uniform bearing and support for each section of pipe along its entire length. Dig “bell” holes after the trench bottom has been graded and compacted. Granular material shall be pea gravel or sand.

D. Provide backfilling and compaction in accordance with provisions of these specifications and under the direction of the Architect to the required density.

E. Provide not less than 4 inches of granular material, the same as duct or piping bedding, all around duct or pipe. Make the first 2 feet of fill in 6-inch layers, each thoroughly compacted as directed with no puddling, and free from rocks, large clods of earth, leaves, branches, and debris. Compact the rest of the backfill as directed, using in the backfill no rocks larger than 4 inches in diameter, and using no rock in the top 12 inches.

3.9 ACCESSIBILITY

A. Install valves, dampers, thermometers, gauges, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the Contract Drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Mechanical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified in Division 08 specifications.

C. Where any duct-mounted access doors or other items requiring access or maintenance are installed above an inaccessible ceiling or behind an inaccessible wall, the Mechanical Contractor shall furnish access doors or panels as required unless noted otherwise. Provide type as specified in Division 08 specifications.

D. Refer to architectural drawings for type of wall and ceiling in each area and for rated construction.

E. Coordinate work of various sections to locate valves, traps, and dampers with others to avoid unnecessary duplication of access doors.

F. The Contractor, along with the Owner’s representative, shall complete the Mechanical Accessibility/Clearance Checklist at the end of this section for all mechanical equipment. The chart shall be submitted to the Architect for approval prior to Substantial Completion. All conflicts shall be resolved to the Architect’s and Owner’s satisfaction prior to submission.

3.10 FLASHINGS

A. Flash and counterflash all piping, conduits and ductwork penetrating roofing membrane with flashing per roofing manufacturer’s recommendations. Refer to architectural drawings for detailing of duct and pipe penetrations through roof.

B. Flash and counterflash all piping, conduits and ductwork penetrating exterior walls. Refer to architectural drawings for detailing of duct and pipe penetrations through walls.

3.11 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, valves, sensors, dampers, detectors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

C. Install equipment, ductwork, and piping level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment, ductwork, and piping to allow right-of-way for piping installed at required slope.

F. Do not install any equipment in an application not recommended by the manufacturer.

3.12 EQUIPMENT ROUGH-IN

A. Rough in all equipment and fixtures as designated on the approved submittals and in the Construction Documents. The Contract Drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the Contract Drawings shall be anticipated and provided for under this Contract.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all ductwork, piping, valves, and fittings. Valve and cap all piping stub-outs. Cap all ductwork stub-outs in a manner suitable for future extension.

3.13 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment (refer to Division 01 specifications) and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Obtain rough-in drawings from the Owner or other contractors prior to roughing-in any services.

C. Provide all services required. Valve and cap all piping, cap all ductwork, and leave in a clean and orderly manner.

3.14 EQUIPMENT FINAL CONNECTIONS

A. Provide all piping and duct final connections for all equipment under Division 23 and as indicated on the drawings.

3.15 MACHINERY DRIVES

A. After tests have been performed on the air-conditioning and air-handling systems, make without cost, not more than one change in the size of non-adjustable sheaves to obtain the required air quantities as direct by the Test and Balance Contractor.

3.16 CLEANUP

A. In addition to cleanup specified in Division 01 specifications, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. Thoroughly flush and clean out all water circulating systems. Remove, clean and replace all strainer elements.

C. During the progress of the work, keep the premises clean and free of debris.

3.17 PAINTING

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal pipe, duct, hangers, supports, rods, hardware, and equipment with one coat of rust-inhibiting primer. Galvanized, stainless-steel, or aluminum ductwork, pipe, supports, hangers, rods and hardware, and factory-painted equipment shall be considered as having primed surface.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Comply with requirements specified in Division 09 for finished painting.

3.18 FIRESTOPPING

A. Coordinate with the firestopping installer for sealing of all penetrations of fire and smoke barriers and other rated assemblies created during the installation of the Division 23 work.

1. Comply with requirements specified in Section 07 84 00.

3.19 OBJECTIONABLE NOISE AND VIBRATION

A. Design, construct and brace the metal partitions, ducts and sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through ducts, piping, conduit, sheet metal work, or the building structure.

END OF SECTION

EDITION -----0223

DIVISION 23 ACCESSIBILITY/CLEARANCE CHECKLIST									
Bldg.	Location	Unit #	Acceptable Access		Conflict	Date	Action	Observer	
			Yes	No				Owner	Contractor

SECTION 23 05 01

DEMONSTRATION & TRAINING FOR HVAC SYSTEMS & COMPONENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes administrative and procedural requirements for demonstration of proper operation of equipment and instructing the Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.

2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for the Owner's use.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Complete demonstrations prior to Substantial Completion.

B. Complete instruction prior to Final Completion.

C. Coordinate demonstration and instruction schedule with the Owner's operations. Adjust schedule as required to minimize disrupting the Owner's operations.

D. Coordinate content of training modules with content of approved Operation & Maintenance Manuals.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system. Include training for all HVAC systems and equipment such as heat pumps, air-conditioners, heating and ventilating units, evaporative coolers, make-up air units, chillers, cooling towers, pumps, fans, air handlers, etc., and as required by individual specification sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.

    b. Operating standards.

    c. Regulatory requirements.

    d. Equipment function.

    e. Operating characteristics.

    f. Limiting conditions.

    g. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.

    b. Operation & maintenance manuals.

    c. Project record documents.

    d. Identification systems.

    e. Warranties and bonds.

    f. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.

    b. Instructions on stopping.

    c. Shutdown instructions for each type of emergency.

    d. Operating instructions for conditions outside of normal operating limits.

    e. Sequences for electric or electronic systems.

    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.

b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.

d. Regulation and control procedures.

e. Control sequences.

f. Safety procedures.

g. Instructions on stopping.

h. Normal shutdown instructions.

i. Operating procedures for emergencies.

j. Operating procedures for system, subsystem, or equipment failure.

k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.

m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.

b. Checking adjustments.

c. Noise and vibration adjustments.

d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.

b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.

d. Procedures for routine cleaning.

e. Procedures for preventive maintenance.

f. Procedures for routine maintenance including the following:

1) Lubrication.

2) Filter replacement.

3) Belt tensioning.

4) Belt replacement.

g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.

b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.

e. Review of spare parts, including lubricants, filters, and belts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect and test each system, subsystem and piece of equipment prior to demonstration. Confirm proper operation prior to scheduling demonstrations.

1. Replace defective work or material.

2. Repeat inspection and testing until defects are eliminated.

B. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements for operation and maintenance data.

3.2 DEMONSTRATION

A. Inspect and operate satisfactorily, in the presence of the Engineer and Owner, each system and item of equipment, including accessories.

3.3 INSTRUCTION

A. Engage qualified instructors to instruct the Owner’s personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. The Owner will furnish the Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed-upon times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with the Owner with an advance notice of at least 7 days.

C. Evaluation: At the conclusion of each training module, assess and document each participant's mastery of the module by use of an oral or demonstration performance-based test.

END OF SECTION

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SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general requirements for single-phase and polyphase, general-purpose, horizontal and vertical, small and medium, squirrel-cage induction motors for use on AC power systems up to 600 volts and installed at equipment manufacturer's factory or shipped separately by the equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

5. Variable frequency and variable speed drives.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this section except when stricter requirements are specified in HVAC equipment schedules or sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Motors 3/4 HP and larger, except as otherwise noted, shall be designed for 3 phase, 60 Hz power supply.

D. Motors 1/2 HP and smaller, except as otherwise noted, shall be designed for 120 volt, single phase, 60 Hz power supply.

E. Motors not directly exposed to weather and located in non-hazardous spaces shall be in dripproof enclosures or as indicated on the drawings.

F. Motors shall be totally enclosed, fan cooled where directly exposed to weather or as indicated on the drawings.

G. High-starting torque, totally enclosed or explosion-proof motors to be used in all hazardous areas or as indicated on the drawings.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104°F and at an altitude of 3,300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multi-Speed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, anti-friction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer’s standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multi-Speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. Bearing Protection Device: Field- or factory-applied shaft grounding ring consisting of metal ring supporting carbon microfibers to provide grounding path between shaft and motor casing.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

5. Electronically commutated.

B. Multi-Speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, anti-friction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Insulation: Class F where motors are installed on roofs outside the airstream.

E. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONICALLY COMMUTATED MOTOR

A. Description: Motor with integral electronics to convert incoming AC power to DC power to drive motor shaft along with controls to vary the speed of the motor based on an internal or external signal.

B. Controls: Provide with internal controls and programming or external inputs, depending on the application, to allow for motor speed control.

C. Motor Protection: Provide with integral safeties to limit motor speed or de-energize motor if operating in an over-temperature or overloaded condition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Arrange and set motors.

B. Line up motors on direct drive equipment using dial-type gauges.

C. Connections and testing of motor for proper rotation/phasing shall be under Division 26.

END OF SECTION

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SECTION 23 05 14

VARIABLE FREQUENCY MOTOR DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes separately enclosed, pre-assembled, combination VFDs, rated 600 volts and less, for speed control of 3-phase, squirrel-cage induction motors.

1.2 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformité Européenne (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IEC: International Electrical Commission.

F. IEEE: Institute of Electrical and Electronics Engineers.

G. IGBT: Insulated-gate bipolar transistor.

H. LAN: Local area network.

I. LED: Light-emitting diode.

J. MCP: Motor-circuit protector.

K. NC: Normally closed.

L. NECA: National Electrical Contractors Association.

M. NEMA: National Electrical Manufacturers Association.

N. NETA: National Electrical Testing Association.

O. NFPA: National Fire Protection Association.

P. NO: Normally open.

Q. OCPD: Overcurrent protective device.

R. PID: Control action, proportional plus integral plus derivative.

S. PWM: Pulse-width modulated.

T. RFI: Radio-frequency interference.

U. VFD: Variable-frequency drive.

1.3 SUBMITTALS

A. Product Data: For each type and rating of VFD indicated.

B. Shop Drawings: For each VFD indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

C. Product certificates.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion or beneficial use.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ABB ACH 580 drive.

B. General Requirements for VFDs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: variable torque.

D. VFD Description: Variable-frequency power converter (rectifier, DC bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by a nationally recognized testing laboratory (NRTL) as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more 3-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both.

2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to the Authorities Having Jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: 3-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: +20 and -20% of VFD input voltage rating.

2. Input AC Voltage Unbalance: Not exceeding 5%.

3. Input Frequency Tolerance: ± 3% of VFD frequency rating.

4. Minimum Efficiency: 97% at 60 Hz, full load.

5. Minimum Displacement Primary-Side Power Factor: 98% under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: 100 kA.

7. Ambient Temperature Rating: Not less than 0°F and not exceeding 104°F for drives mounted inside conditioned spaces.

8. Ambient Temperature Rating: Not less than 0°F and not exceeding 122°F for drives mounted outside or in unconditioned spaces.

9. Ambient Storage Temperature Rating: Not less than -4°F and not exceeding 140°F.

10. Humidity Rating: Less than 95% (non-condensing, non-corrosive).

11. Altitude Rating: Not less than 3,300 feet.

12. Vibration Withstand: Comply with IEC 60068-2-6.

13. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.3 times the base load current for 2 seconds.

14. Starting Torque: Minimum 100% of rated torque from 3 to 60 Hz.

15. Output Carrier Frequency: Selectable; 1 to 12 kHz.

16. Stop Modes: Programmable; includes fast, free-wheel, and DC injection braking.

H. Inverter Logic: Microprocessor based, 16 or 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFDs to follow remote-control electrical signal over a minimum 40:1 speed range.

J. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25% of maximum rpm.

2. Maximum Speed: 80 to 110% of maximum rpm.

3. Acceleration: 0.1 to 999.9 seconds.

4. Deceleration: 0.1 to 999.9 seconds.

5. Current Limit: 30 to minimum of 150% of maximum rating.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide 3-phase protection against damage from supply voltage surges 10% or more above nominal line voltage.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under- and overvoltage trips.

4. Inverter overcurrent trips.

5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.

6. Critical frequency rejection, with three selectable, adjustable deadbands.

7. Instantaneous line-to-line and line-to-ground overcurrent trips.

8. Loss-of-phase protection.

9. Reverse-phase protection.

10. Short-circuit protection.

11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

P. Integral Input Disconnecting Means and OCPD: NEMA AB 1, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115% of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicator displaying unit status.

1. Power on.

2. Bypass enabled for units provided with a bypass.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View Only; View and Operate; and View, Operate, and Service.

a. Control Authority: Supports at least four conditions:

1) Off.

2) Local Manual Control at VFD.

3) Local Automatic Control at VFD.

4) Automatic Control through a Remote Source.

C. Historical Logging Information and Displays:

1. Running log of total power versus time.

2. Total run time.

3. Fault log, maintaining last three faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFD door and connected to display VFD parameters including, but not limited to:

1. Output frequency (Hz).

2. Motor speed (rpm).

3. Motor status (running, stop, fault).

4. Motor current (amperes).

5. Motor torque (percent).

6. Fault or alarming status (code).

7. PID feedback signal (percent).

8. DC-link voltage (VDC).

9. Setpoint frequency (Hz).

10. Motor output voltage (VAC).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs, selectable 0 to 10 VDC or 4 to 20 mA DC.

b. A minimum of six multi-function programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

a. 0 to 10 VDC.

b. 4 to 20 mA DC.

c. Potentiometer using up/down digital inputs.

d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of two programmable analog output signals (4 to 20 mA DC), which can be configured for any of the following:

a. Output frequency (Hz).

b. Output current (load).

c. DC-link voltage (VDC).

d. Motor torque (percent).

e. Motor speed (rpm).

f. Setpoint frequency (Hz).

4. Remote Indication Interface: A minimum of three programmable dry-circuit relay outputs (120 VAC, 1 A) for remote indication of the following:

a. Motor running.

b. Setpoint speed reached.

c. Fault and warning indication (overtemperature or overcurrent).

d. PID high- or low-speed limits reached.

F. PID Control Interface: Provides closed-loop setpoint, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: Two.

G. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFD status and alarms and energy usage. Allows VFD to be used with an external system within a multi-drop LAN configuration; settings retained within VFD's non-volatile memory.

1. Network Communications Ports: RS-422/485.

2. Embedded BAS Protocols for Network Communications: BACnet IP, BACnet MS/TP, Johnson Metasys N2, MODBUS RTU, MODBUS TCP, General Protocol 1 (GP1) FLN; protocols accessible via the communications ports. Provide optional, add-on protocol if required for BAS interface.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Internal 5% impedance reactors. Reactors shall be dual positive and negative DC bus reactors, or AC line reactors.

B. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 OPTIONAL FEATURES

A. Damper control circuit with end of travel feedback capability where indicated on the drawings or needed for proper system operation.

B. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.5 ENCLOSURES

A. VFD Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

2. Outdoor Locations: Type 3R.

3. Kitchens or Wash-Down Areas: Type 4X, stainless steel.

4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-Corrosive Liquids: Type 12.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFD as "Plenum Rated."

2.6 ACCESSORIES

A. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, Basic Impulse Insulating Level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

B. Cooling Fan and Exhaust System: For NEMA 250, Type 1 or Type 12; UL 508 component recognized: Supply fan, with composite intake and exhaust grilles; 120 VAC; obtained from integral CPT.

C. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4X and Type 12 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

D. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R, Type 4X and Type 12 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

2.7 SOURCE QUALITY CONTROL

A. VFDs will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall-Mounting Controllers: Install VFDs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in control circuits if not factory installed. Comply with requirements in Specification Section 26 28 13, Overcurrent Protection.

D. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify VFDs, components, and control wiring. Comply with requirements for identification specified in Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each VFD with engraved nameplate.

3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFDs and remote devices and facility's central-control system. Comply with requirements in Specification Section 23 05 20, Electrical and Control Wiring for Mechanical Systems.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.

2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency or manufacturer's representative to perform tests and inspections.

B. Perform tests and inspections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at VFD locations are within 10% of motor nameplate rated voltages. If outside this range for any motor, notify the Engineer before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units onsite, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. VFDs will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

G. Provide onsite harmonic distortion testing, if required by the Owner or Engineer.

3.5 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable circuit-breaker trip ranges as specified.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner’s maintenance personnel to adjust, operate, reprogram, and maintain VFDs. Provide minimum of 4 hours of onsite training at the time of project closeout.

END OF SECTION

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SECTION 23 05 15

ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following enclosed controllers rated 600 volts and less:

1. Full-voltage manual.

2. Full-voltage magnetic.

1.2 DEFINITIONS

A. BAS: Building automation system.

B. CPT: Control power transformer.

C. IEC: International Electrical Commission.

D. IEEE: Institute of Electrical and Electronics Engineers.

E. LAN: Local area network.

F. MCCB: Molded-case circuit breaker.

G. MCP: Motor circuit protector.

H. N.C.: Normally closed.

I. NECA: National Electrical Contractors Association.

J. NEMA: National Electrical Manufacturers Association.

K. NETA: National Electrical Testing Association.

L. N.O.: Normally open.

M. OCPD: Overcurrent protective device.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include dimensions, required clearances, and wiring diagrams for power, signal, and control wiring.

B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or pushbutton action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Rockwell Automation, Inc.; Allen-Bradley brand.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing or two speed as required.

3. Surface mounting.

4. Pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or pushbutton action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Rockwell Automation, Inc.; Allen-Bradley brand.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing or two speed as required.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset pushbutton; bimetallic type.

4. Surface mounting.

5. Pilot light.

D. Integral Horsepower Manual Controllers: “Quick-make, quick-break” toggle or pushbutton action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Rockwell Automation, Inc.; Allen-Bradley brand.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing or two speed as required.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset pushbutton; bimetallic type.

4. Surface mounting.

5. Pilot light.

E. Definite Purpose Contactors: For remote control of single-phase motors.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D, Type DPA, Class 8910 or comparable product by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Rockwell Automation, Inc.; Allen-Bradley brand.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing, double-break contacts.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset pushbutton; bimetallic type.

4. Surface mounting.

F. Magnetic Controllers: Full voltage, across the line, electrically held, NEMA device.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D Class 8536 Type S or comparable product by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Rockwell Automation, Inc.; Allen-Bradley brand.

d. Siemens Energy & Automation, Inc.

e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing.

3. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 24 VAC; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

6. Bimetallic Overload Relays:

a. Inverse-time-current characteristic.

b. Class 20 tripping characteristic.

c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. Solid-State Overload Relay:

a. Switch or dial selectable for motor running overload protection.

b. Sensors in each phase.

c. Class 20 or Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

8. External overload reset pushbutton.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

2. Outdoor Locations: Type 3R.

3. Kitchen Wash-Down Areas: Type 4X, stainless steel.

4. Other Wet or Damp Indoor Locations: Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-Corrosive Liquids: Type 12.

2.3 ACCESSORIES

A. Pushbuttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 - EXECUTION

3.1 GENERAL

A. Controllers: Furnish controllers for all single-phase and polyphase motors provided as part of the Division 23 work. Controllers shall be installed by the Division 26 Contractor. Controllers are not required for the following:

1. Motors controlled by a variable frequency drive.

2. Motors that are provided with controllers as part of packaged equipment.

3. Motors controlled through a motor control center. Motor control centers are specified in Division 26.

B. Accessories: Furnish controllers with the required accessories, auxiliary contacts, holding coils, etc., as required to achieve the sequence of controls, interlocking, etc., indicated on the drawings and as required for a fully functioning system.

1. All definite purpose contactors and magnetic controllers shall be furnished with a hand-off-auto (HOA) switch.

2. All single-phase controllers shall be provided with undervoltage and overvoltage relays.

3. All polyphase controllers shall be provided with phase-failure, phase-reversal, and undervoltage and overvoltage relays.

3.2 APPLICATION

A. Manual Operation: Where only manual operation is indicated.

1. Fractional Horsepower Motors with Internal Overload Protection: Provide with motor-starting switches.

2. Fractional Horsepower Motors without Internal Overload Protection: Provide with fractional horsepower manual controllers.

3. Integral Horsepower Motors up to 10 Horsepower: Provide with integral horsepower manual controllers.

B. Automatic and/or Manual Operation: Where a motor is to be controlled manually or automatically by the BAS, or other control scheme.

1. Fractional Horsepower Motors: Provide with definite purpose contactors or magnetic controllers.

2. Integral Horsepower Motors: Provide with magnetic controllers.

3. Multi-Speed Motors: Multi-speed magnetic controller selected to match motor type.

3.3 INSTALLATION

A. Installation shall be by the Division 26 Contractor.

B. Installation of power wiring shall be by the Division 26 Contractor.

C. Install control wiring.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26.

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identification of controllers, line-voltage components, and power wiring shall be done by the Division 26 Contractor.

B. Identify low-voltage components and control wiring.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's BAS. Comply with requirements in Division 23.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.

2. Test continuity of each control circuit.

C. Tests and Inspections:

1. Inspect controllers, control wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test continuity of each control circuit.

3. Test each motor for proper phase rotation.

4. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

5. Correct malfunctioning units onsite, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Reports shall be on the Contractor’s letterhead and shall include, at a minimum, the following information:

1. Testing technician’s name and signature.

2. Data and time testing was performed.

3. Ambient temperature and weather conditions.

4. Manufacturer, model number, and other pertinent data of the test equipment.

5. Statement of “As Left” condition.

6. Pass/Fail statement relative to NETA Chapter 10 recommendations.

7. Deficiencies detected.

8. Remedial action taken.

9. Observations after remedial action.

10. Recommendations, if any.

F. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the settings of adjustable motor overloads to match the motor full-load amperes.

3.8 DEMONSTRATION

A. Train the Owner’s maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION

Edition 0909-1119

SECTION 23 05 17

SLEEVES & SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Sleeves.

2. Sleeve-seal systems.

3. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast- or ductile-iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: Minimum thickness 0.0239-inch; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.

2. CALPICO, Inc.

3. Link-Seal by GPT, an EnPro Industries Company.

4. The Metraflex Company.

5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel or reinforced nylon polymer.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

1. Sleeves are not required for core-drilled holes through exterior walls or slab-on-grade floors.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and interior of sleeve.

1. For core-drilled holes, size hole large enough to provide 1-inch annular space between piping and concrete wall or slab-on-grade floor.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level unless otherwise indicated.

2. Using grout, seal the space outside of sleeves in slabs and walls.

D. Install sleeves in core-drilled holes in concrete floors in mechanical equipment areas or other wet areas.

1. Extend sleeves 2 inches above finished floor level unless otherwise indicated.

2. Using grout, seal the space outside of sleeves.

E. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 specifications.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 specifications.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior, above and below grade, concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve or hole. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade: Cast-iron wall sleeves or galvanized-steel wall sleeves.

2. Exterior Concrete Walls Below Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Foundation or Stem Walls Below Grade: Cast-iron wall sleeves.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve.

4. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.

a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

5. Concrete Slabs Above Grade:

a. Non-Rated Floors: Cast-iron wall pipes or galvanized-steel wall pipes.

b. Fire-Rated Floors: Galvanized-steel wall pipes.

6. Interior Partitions:

a. Non-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves.

b. Fire-Rated Walls: Galvanized-steel-pipe sleeves or galvanized-steel-sheet sleeves as allowed per UL penetration detail.

END OF SECTION

Edition 0308-0123

SECTION 23 05 18

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Escutcheons.

2. Floor plates.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and set screw fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw and polished chrome-plated finish.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Insulated Piping: One-piece, stamped-steel type.

c. Bare Piping: One-piece, cast-brass type.

2. Escutcheons for existing piping shall be split-casting, cast-brass type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type,

2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

Edition 0308-1109

SECTION 23 05 19

METERS & GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Thermometers.

2. Thermowells.

3. Dial-type pressure gages.

4. Gage attachments.

5. Turbine flowmeters.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Product certificates.

D. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. H.O. Trerice Co.

b. Miljoco Corporation.

c. Palmer Wahl Instrumentation Group.

d. Weiss Instruments, Inc.

e. Winters Instruments – U.S.

2. Standard: ASME B40.200.

3. Case: Cast aluminum, 9 inch nominal size unless otherwise indicated.

4. Case Form: Adjustable angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in degrees F.

7. Window: Glass.

8. Stem: Aluminum and of length to suit installation.

   a. Design for Air Duct Installation: With ventilated shroud.

   b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

10. Accuracy: ± 1% of scale range or one scale division, to a maximum of 1-1/2% of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Standard: ASME B40.200.

B. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

C. Material for Use with Copper Tubing: Brass.

D. Material for Use with Steel Piping: Stainless Steel.

E. Type: Stepped shank unless straight or tapered shank is indicated.

F. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

G. Internal Threads: 1-1/4 inch, with ASME B1.1 screw threads.

H. Bore: Diameter required to match thermometer bulb or stem.

I. Insertion Length: Length required to match thermometer bulb or stem.

J. Lagging Extension: Include on thermowells for insulated piping and tubing.

K. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

2.4 PRESSURE GAGES

A. Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. H.O. Trerice Co.

b. Marsh Bellofram.

c. Miljoco Corporation.

d. Palmer Wahl Instrumentation Group.

e. Weiss Instruments, Inc.

f. Weksler.

2. Standard: ASME B40.100.

3. Case: Cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi and kPa.

8. Pointer: Dark-colored metal.

9. Window: Glass.

10. Ring: Metal.

11. Accuracy: Grade A, ± 1% of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and surge-dampening device. Include extension for use on insulated piping.

B. Valves: Bronze or stainless-steel ball, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads.

2.6 FLOWMETERS

A. Turbine Flowmeters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ONICON Incorporated, Model F-1210 or comparable product by one of the following:

a. Data Industrial Corp.

b. Hoffer Flow Controls, Inc.

c. ISTEC Corporation.

d. ONICON Incorporated.

2. Description: Flowmeter with sensor and indicator.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

4. Sensor: Dual impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.

a. Design: Device or pipe fitting with dual inline turbines and integral direct-reading scale for water.

b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.

c. Minimum Pressure Rating: 150 psig.

d. Minimum Temperature Rating: 180°F.

5. Indicator: Integral part of sensor or a separate meter.

6. Accuracy: ± 1-1/2%.

7. Display: Shows rate of flow.

8. Operating Instructions: Include complete instructions with each flowmeter.

9. Building Automation System Interface: Selectable 4 to 20 mA or 0 to 10 VDC output.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer or temperature sensor connectors. Include bushings if required to match sizes.

C. Install thermowells as directed by the Building Automation System Contractor.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install valve and snubber in piping for each pressure gage for fluids (except steam).

J. Assemble and install connections, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

K. Install flowmeter elements in accessible positions in piping systems.

L. Install flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

M. Install permanent indicators on walls or brackets in accessible and readable positions.

N. Install thermometers where indicated on the drawings and in the following locations:

1. Inlet and outlet of each hydronic boiler.

2. Two inlets and two outlets of each chiller.

3. Inlet and outlet of each hydronic coil in air-handling units.

4. Two inlets and two outlets of each hydronic heat exchanger.

5. Inlet and outlet of each thermal-storage tank.

O. Install pressure gages where indicated on the drawings and in the following locations:

1. Discharge of each pressure-reducing valve.

2. Two inlets and two outlets of each chiller. Provide one gage per tube bundle with 1/2-inch piping and ball valves to allow measurement at bundle inlet and outlet.

3. Two inlets and two outlets of each hydronic heat exchanger. Provide one gage per heat exchanger side with 1/2-inch piping and ball valves to allow measurement at inlet and outlet.

4. Each hydronic pump. Provide one gage per pump with 1/2-inch piping and ball valves to allow measurement at strainer inlet, pump inlet and pump discharge.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements or transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer’s written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100°F.

B. Scale Range for Heating, Hot-Water Piping: 20 to 240°F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION

Edition 0607-1015

SECTION 23 05 20

ELECTRICAL & CONTROL WIRING FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section is to be used for all low- and line-voltage wiring for mechanical controls. All line-voltage work shall be performed by a licensed contractor qualified to perform the work and shall comply with the requirements contained in this section or in Division 26.

B. This section does not apply to plenum rated cables used for electrically activated remote damper operators.

C. This section includes the following:

1. Metal conduits, tubing, and fittings.

2. Non-metallic conduits, tubing, and fittings.

3. Metal wireways and auxiliary gutters.

4. Surface raceways.

5. Boxes, enclosures, and cabinets.

6. Low-voltage control cabling.

7. Conductors and cables rated 600 volts and less.

8. Connectors, splices, and terminations rated 600 volts and less.

9. Identification of power and control cables.

10. Identification for conductors.

1.2 DEFINITIONS

A. Low-Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control and signaling power-limited circuits.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s technical data, materials of construction, and listings.

B. Field quality-control test reports.

C. Maintenance data.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction (AHJ), and marked for intended use.

C. Comply with NFPA 70.

D. Comply with ANSI A13.1 for identification devices.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

1. Color: Factory-applied color per schedule below.

a. HVAC Control Wiring: White.

b. Power – Normal: Natural.

c. Power – Standby: Orange.

E. FMC: Comply with UL 1; zinc-coated steel or aluminum.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

2. Fittings for EMT:

a. Material: Steel.

b. Type: Set screw or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by the AHJ for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NON-METALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Non-metallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250; Type 1, Type 3R, Type 4 or Type 12, as required by location; and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Where installed in finished spaces, match color of adjacent surfaces.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Box extensions used to accommodate new building finishes shall be of the same material as the recessed box.

D. Device Box Dimensions: 4" square x 2-1/8" deep or 4" x 2-1/8" x 2-1/8" deep.

E. Gangable boxes are prohibited.

F. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250; Type 1, Type 3R, Type 4 or Type 12, as required by location; with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

G. Cabinets:

1. NEMA 250; Type 1, Type 3R or Type 12, as required by location; galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, #16 or #18 AWG, stranded (19 x 29) tinned-copper conductors.

2. PVC insulation.

3. Unshielded.

4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.

2.7 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with the following:

1. NEMA WC 70 for Types THHN-THWN and XHHW.

2. UL 83 for Types TW and TF.

2.8 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M; Electrical Products Division.

2. AFC Cable Systems, Inc.

3. Hubbell Power Systems, Inc.

4. O-Z/Gedney; EGS Electrical Group LLC.

5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.9 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.10 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.

2. Concealed Conduit, Aboveground: GRC, IMC, or EMT.

3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC, direct buried or concrete encased.

4. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following but not limited to:

a. Loading dock.

b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Gymnasiums.

4. Concealed in Interior Walls and Partitions: EMT.

5. Concealed Above or In Ceilings: EMT.

6. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

7. Damp or Wet Locations: GRC or IMC.

8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: Trade size 3/4 inch.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use set screw or compression, steel fittings. Comply with NEMA FB 2.10.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduit, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only in retrofit applications where indicated.

3.2 RACEWAY INSTALLATION

A. Install all cabling, conductors, and wiring in raceways except where noted otherwise on the drawings or in other sections.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on the drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Comply with requirements in Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment, for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1 inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by the Architect for each specific location.

J. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or GRC for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer’s written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than #4 AWG.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

N. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where conduits pass from humidity controlled spaces to non-humidity controlled spaces.

3. Where an underground service raceway enters a building or structure.

4. Where otherwise required by NFPA 70.

Q. Expansion-Joint Fittings:

1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 48 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for motors.

1. Use FMC in indoor, dry locations.

2. Use LFMC in all other locations.

S. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

T. Locate boxes so that cover or plate will not span different building finishes.

U. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 specifications for pipe less than 6 inches in nominal diameter.

2. Install backfill as specified in Division 31 specifications.

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 specifications.

4. Install manufactured rigid steel conduit elbows for stub-ups at equipment and at building entrances through floor.

a. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

3.4 CONDUCTOR MATERIAL APPLICATIONS

A. Control Circuit Sizing: Minimum sizes are listed below:

1. Class 1 remote-control and signal circuits, #14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits, #16 AWG.

3. Class 3 low-energy, remote-control, alarm, and signal circuits, #12 AWG.

B. Branch Circuits: Copper. Solid for #10 AWG and smaller; stranded for #8 AWG and larger.

C. Branch Circuit Sizing: Size conductors for circuits with less than a 20 ampere connected load, maximum of 16 amperes actual load, as follows:

1. For 120-volt circuits up to 65 feet in length from panel to center of load: Not smaller than No. 12.

2. For 120-volt circuits up to 110 feet in length from panel to center of load: Not smaller than No. 10.

3. For 120-volt circuits up to 165 feet in length from panel to center of load: Not smaller than No. 8.

4. For 120-volt circuits up to 255 feet in length from panel to center of load: Not smaller than No. 6.

5. For 208-volt circuits up to 110 feet in length from panel to center of load: Not smaller than No. 12.

6. For 208-volt circuits up to 185 feet in length from panel to center of load: Not smaller than No. 10.

7. For 208-volt circuits up to 280 feet in length from panel to center of load: Not smaller than No. 8.

8. For 208-volt circuits up to 440 feet in length from panel to center of load: Not smaller than No. 6.

9. For 277-volt circuits up to 150 feet in length from panel to center of load: Not smaller than No. 12.

10. For 277-volt circuits up to 250 feet in length from panel to center of load: Not smaller than No. 10.

11. For 277-volt circuits up to 380 feet in length from panel to center of load: Not smaller than No. 8.

12. For 277-volt circuits up to 590 feet in length from panel to center of load: Not smaller than No. 6.

3.5 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

A. Comply with NECA 1.

B. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN or XHHW, single conductors in raceway.

C. Branch Circuits Concealed in Walls, and Partitions: Type THHN-THWN or XHHW, single conductors in raceway.

D. Branch Circuits Concealed Above or in Ceilings: Type THHN-THWN or XHHW, single conductors in raceway.

E. Branch Circuits Concealed Above Lay-In Ceilings: Type THHN-THWN or XHHW, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN or XHHW, single conductors in raceway.

G. Class 1 and 2 Control Circuits: Type THHN-THWN or XHHW, in raceway unless noted otherwise.

1. Final raceway connections for low-voltage control wiring to equipment, actuators and similar devices may be omitted where the devices are located above lay-in ceilings. Length of exposed wire is to be less than 24 inches.

H. Class 3 Control Circuits: Type TW or TF in raceway unless noted otherwise.

1. Final raceway connections for low-voltage control wiring to equipment, actuators and similar devices may be omitted where the devices are located above lay-in ceilings. Length of exposed wire is to be less than 24 inches.

3.6 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal raceways in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install raceways parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.

F. Identify and color-code conductors and cables.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.7 IDENTIFICATION INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by the manufacturer of the identification device.

C. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.8 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 Volts or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 Volts or Less: Use colors listed below for ungrounded branch-circuit conductors.

a. Color shall be factory applied.

b. Colors for 208/120-Volt Circuits:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral: White.

c. Colors for 480/277-Volt Circuits:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

4) Neutral: Gray.

B. Control Systems Conductor Identification: Identify field-installed control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with the system used by the manufacturer for factory-installed connections.

3. Coordinate identification with the Project Drawings, manufacturer's wiring diagrams, and the Operation & Maintenance Manual.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

3.9 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.10 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Division 26.

3.11 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Specification Section 23 05 17, Sleeves and Sleeve Seals for HVAC Piping.

3.12 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 specifications.

3.13 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.

2. Repair damage to paint finishes with matching touchup coating recommended by the manufacturer.

3.14 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections: Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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SECTION 23 05 23

GENERAL DUTY VALVES FOR HVAC HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Ball valves.

2. Iron butterfly valves.

B. Related Sections:

1. Division 23 HVAC piping sections for specialty valves applicable to those sections only.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC Valve Schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: The same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.

2. Handlever: For quarter-turn valves NPS 6 and smaller.

3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the Valve Installation article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Conbraco Industries; Apollo Valves.

2. FNW Grinnell.

3. Hammond Valve.

4. Kitz Corporation of America.

5. Milwaukee Valve Company.

6. Nibco Inc.

7. Pratt Industrial.

8. Watts.

2.2 BALL VALVES

A. Two-Piece, Full-Port Ball Valves:

1. Standard: MSS SP-110.

2. CWP Rating: 600 psi.

3. Body Design: Two piece.

4. Body Material:

a. Valves 2 Inches and Smaller: Forged or cast bronze.

b. Valves 2-1/2 Inches and Larger: Forged or cast bronze or brass.

5. Ends: Threaded.

6. Seats: PTFE or TFE.

7. Stem: Stainless steel, blowout proof with adjustable packing nut.

8. Ball: Stainless steel.

9. Port: Full.

2.3 BUTTERFLY VALVES

A. Iron, Lug Body Butterfly Valves:

1. Standard: MSS SP-67, Type I.

2. CWP Rating: 150 psig.

3. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron, epoxy coated, with actuator flange.

5. Seat and Seal: EPDM.

6. Stem: One- or two-piece stainless steel.

7. Disc: Aluminum bronze, coated ductile iron, or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem and handle movement.

E. Install check valves with minimum five straight pipe diameters upstream of valve.

F. Install gear actuator with hand wheel axle in horizontal position to prevent accidental engagement or disengagement.

G. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not otherwise indicated and except as specified in piping system sections, use the following:

1. Shutoff Service: Ball or butterfly valves.

2. Throttling Service: Ball or butterfly valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER, CONDENSER WATER, HEATING WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball valves.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron butterfly valves, NPS 2-1/2 to NPS 24.

END OF SECTION

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SECTION 23 05 29

HANGERS & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Metal pipe hangers and supports.

2. Trapeze pipe hangers.

3. Thermal-hanger shield inserts.

4. Fastener systems.

5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water with no load transmitted to connected equipment.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include product data for components:

1. Trapeze pipe hangers.

2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Surface-Burning Characteristics: For tapes, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to the Authorities Having Jurisdiction. Factory-label tapes with appropriate markings of the applicable testing agency.

1. Tape Installed in Return Plenums: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Tape Installed Elsewhere: No testing requirement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers shall be one of the following unless noted otherwise:

1. Anvil International.

2. B-Line Systems.

3. Elgen.

4. Kin-Line.

5. Michigan Hanger Co.

6. National Pipe Hanger Corp.

7. PHD Manufacturing.

8. PHS Industries.

9. Pipe Technology and Products.

10. Unistrut.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Non-Metallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, pipe clamps, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot or Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

E. Shield: Shields shall be a minimum of 18 gauge galvanized steel, 12 inches long for piping 6 inches and smaller. Shields shall be a minimum of 16 gauge galvanized steel, 18 inches long for pipe over 6 inches.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.

1. Properties: Post-hardening, volume adjusting, non-staining, non-corrosive, and non-gaseous.

2. Design Mix: 5,000-psi, 28-day compressive strength.

C. Tape for Plenum Use:

1. Polypropylene backing with acrylic adhesive, Hart & Cooley Part No. 011371.

2. Polyethylene-coated cloth backing with rubber adhesive, Uline Black Nashua 398 Duct Tape, Model No. S-17236BL.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Hanger Sizing: Size hangers on insulated piping to fit outside of covering.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation: Install fasteners in strict accordance with manufacturer’s written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping: Thermal-hanger shield inserts shall be used. Install with insulation the same thickness as piping insulation. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

N. Conduit Support Installation:

1. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in this article.

2. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 EQUIPMENT SUPPORTS

A. Design, cut, fit, and place miscellaneous supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment from structure overhead, or above floor or roof.

1. Use steel supports except where wood supports are indicated on the drawings.

B. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strainers and interference with piping connections, tube pulling or other maintenance operations.

2. Where saddles are required, use cast-iron or welded-steel saddles with curvature to fit the tank shell.

3. Mount power-driven equipment on common base with driver.

C. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 23.

D. Concrete Housekeeping Pads and Isolation Bases: Work under this section includes coordination of construction of all concrete foundations indicated or required for equipment specified under Division 23. Materials and workmanship shall be described in Division 03 specifications. Anchor equipment to concrete housekeeping pads and isolation bases according to equipment manufacturer's written instructions and according to seismic codes at project.

1. Construct concrete housekeeping pads and isolation bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete pads to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the pad.

3. Install epoxy-coated anchor bolts for supported equipment that extends through concrete pads, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

E. Grouting:

1. Grout under all equipment after leveling, filling completely the space between machinery bed plate and foundation surface as specified in Division 03 specifications.

2. Mix and install grout for mechanical equipment base bearing surfaces, pumps and other equipment base plates, and anchors.

3. Clean surfaces that will come into contact with grout.

4. Provide forms as required for placement of grout.

5. Avoid air entrapment during placement of grout.

6. Place grout, completely filling equipment bases.

7. Place grout on concrete pads and isolation bases and provide smooth bearing surface for equipment.

8. Place grout around anchors.

9. Cure placed grout.

10. Finish exposed surface of grout for a neat appearance.

F. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

D. Paint after fabrication with a rust-inhibitive primer.

3.4 WOOD FABRICATIONS

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 specifications.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system sections.

C. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

D. Use hangers and supports with galvanized metallic coatings for piping and equipment that is exposed to weather and that will not have field-applied finish.

E. Use stainless-steel pipe hangers and stainless-steel attachments for corrosive atmospheres.

F. Wrap copper piping with not less than two layers of 10-mil-thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1,050°F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 1-1/2 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

5. Single-Pipe Rolls (MSS Type 43): For suspension of pipes NPS 1 to NPS 30, with one rod if longitudinal movement caused by expansion and contraction might occur.

6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

7. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Conduit Support Applications:

1. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical conduit.

2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel-slotted or other support system, sized so capacity can be increased by at least 25% in future without exceeding specified design load limits.

a. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel Turnbuckles (MSS Type 13).

2. Steel Clevises (MSS Type 14): For 120 to 450°F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS-Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Include retaining clip.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes. Include retaining clip.

7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lbs.

b. Medium (MSS Type 32): 1,500 lbs.

c. Heavy (MSS Type 33): 3,000 lbs.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system sections.

END OF SECTION

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SECTION 23 05 48.13

VIBRATION CONTROLS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Spring hangers.

1.2 DEFINITIONS

A. Sound Critical: Assembly spaces such as classrooms, auditoriums, etc.; normally occupied rooms such as offices, call centers, etc.; vibration critical areas such as data rooms, technical manufacturing areas, etc.; or other areas as indicated.

B. Non-Sound Critical: Not normally occupied areas such as storage rooms, electrical rooms, mechanical yards, commercial kitchens, scullery areas, etc.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

B. Welding certificates.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: The following products are based on Mason Industries. Subject to compliance with requirements, provide comparable products by one of the following:

1. Amber/Booth Company, Inc.

2. Kinetics Noise Control.

3. Mason Industries.

4. Vibration Mountings & Controls, Inc.

B. Style F - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50% of the required deflection at rated load.

4. Lateral Stiffness: More than 80% of rated vertical stiffness.

5. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.

6. Elastomeric Elements: Molded, oil-resistant rubber or neoprene.

a. Minimum 1-1/4-inch-thick element at top of hanger with steel-washer-reinforced rod support and bushing projecting through top of frame.

b. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer’s standard paint applied to factory-assembled equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be zinc electroplated.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Engage a factory-authorized representative to inspect the intended equipment locations for deficiencies and to instruct installers in correct equipment installation procedure and sequence.

B. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

C. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

C. Select vibration isolation elements and deflections in accordance with the following table:

Equipment	Location	Vibration Isolation Element (Minimum Deflection)
Ceiling Mounted Equipment Fan Coil Units Indoor Units Watersource Heat Pumps Inline Fans Fan-Powered VAV Boxes	Suspended	Style F (0.75 inches ≤ 5 HP) (1.5 inches ≥ 7.5 HP)

3.3 VIBRATION-CONTROL INSTALLATION

A. Install bushing assemblies for mounting bolts for vibration isolated wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

C. Drilled-In Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the Structural Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

D. Riser Isolation: Suspended risers with spring hangers or supported with spring mounts, anchored with piping anchors, and guided with sliding guides.

1. Suspend horizontal pipe runs and branches with spring hangers for the first three supports from the risers.

2. Steel springs shall be selected to provide a minimum of 3/4-inch static deflection except in those expansion locations where additional deflection is required to limit load changes to +25% of the initial load.

E. Short-Circuiting: Avoid short-circuiting to the building any vibration-isolated piece of equipment, pipe, duct or other component. Short-circuits with or via rigid conduits, drain lines, rigid braces, rigid sleeves, framing, etc., shall all be avoided. The Contractor shall oversee trades to prevent the short-circuiting of any vibration isolation system and shall bring any unresolved conflicts to the Architect's attention.

F. Incidentals: Supply and install any incidental equipment or parts needed to meet the requirements stated, even if not specified or shown on the drawings.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight and temperature.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Engage a factory-authorized representative to inspect the completed installation prior to the closing in of any unfinished work and again at the completion of the project. Complete any corrective work identified during the inspection.

C. Tests and Inspections:

1. Measure isolator restraint clearance.

2. Measure isolator deflection.

3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Equipment labels.

2. Warning signs and labels.

3. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multi-layer, multi-color plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

6. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's drawing designation or unique equipment number, and area(s) served by equipment. Coordinate with the Owner.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multi-layer, multi-color plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2" x 3/4".

F. Minimum Letter Size: 1/2 inch. Include secondary lettering 3/8 inch.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: As indicated on the drawings or required by the local authority.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

1. Complying with latest edition of ANSI/ASME A13.1 unless specifically noted otherwise or directed by the Owner.

B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Strap-On Pipe Labels: Semi-rigid plastic formed to fit circumference of pipe and to attach to pipe with stainless-steel worm-drive clamps.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent adhesive backing.

E. Pipe Label Contents: Include identification of piping service using the same designations or abbreviations as used on the drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.4 PAINTED PIPE AND DUCT LABELS

A. Paint: Alkyd paint selected for use without a primer based on base material.

B. Color: Match background color indicated in Label Color Schedules below.

C. Application: Use stencils for paint application.

D. Lettering Size: At least 3 inches high.

E. Flow Arrows: To show flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Comply with requirements in latest edition of ANSI/ASME 13.1 unless noted otherwise.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment. Reduce spacing to 5 feet when required by code.

7. Spaced at maximum 10 feet on piping above removable acoustical ceilings. Reduce spacing to 5 feet when required by code.

C. Use painted pipe labels outside where piping is exposed to weather.

1. Apply one or two coats using the same stencil as required for thorough coverage.

D. Pipe Label Color Schedule:

1. Chilled-Water Piping:

a. Background Color: Green.

b. Letter Color: White.

2. Condensate Drain Piping:

a. Background Color: Green.

b. Letter Color: White.

3. Heating Hot Water Piping:

a. Background Color: Green.

b. Letter Color: White.

4. Refrigerant Piping:

a. Background Color: Yellow.

b. Letter Color: Black.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

B. Clean faces of mechanical identification devices.

END OF SECTION

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SECTION 23 05 93

TESTING, ADJUSTING & BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Balancing Air Systems.

2. Balancing Hydronic Systems.

3. Balancing HVAC Equipment.

1.2 APPROVED CONTRACTORS

A. Engage the services of one of the following:

1. Able Balance, LLC.

2. ABM Building Services, LLC., Phoenix, Arizona Balance Division.

3. Arizona Air Balance Co.

4. ETB Arizona.

5. Phoenix Test and Balance, LLC.

6. Precision Air.

7. Southwest Testing and Balancing, LLC.

8. Systems Commissioning & Testing, Inc.

9. TAB Technology, Inc.

10. Technical Air Balance.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB work.

1.4 SUBMITTALS

A. Contractor Qualifications: Include AABC or NEBB certificates for proposed personnel, test instrument certifications.

B. Certified TAB reports.

C. Sealed special inspection reports.

1.5 QUALITY ASSURANCE

A. Supervising technicians and firm shall be AABC or NEBB certified.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB Contractor's forms.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, Instrumentation.

E. Perform special inspections as required herein and by the AHJ.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents and approved submittals for the HVAC systems and equipment to become familiar with project requirements and to discover conditions in system designs that may preclude proper TAB of systems and equipment or inefficient operation. Report findings and recommendations directly to the Engineer within 30 days of document review.

B. Examine ceiling plenums used for return or relief air to verify that there is a proper path for return and relief air from all areas of the building. Verify that penetrations through walls between plenum and non-plenum areas are sealed.

C. Examine equipment performance data including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

D. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, filters are clean and in place, and equipment with functioning controls is ready for operation.

E. Examine placement of the hydronic differential pressure sensor and confirm it is installed where indicated on the drawings.

F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

G. Examine operating safety interlocks and controls on HVAC equipment.

H. Report deficiencies discovered before and during performance of TAB procedures directly to the Engineer and Mechanical Contractor. Observe and record system reactions to changes in conditions. Record default setpoints if different from indicated values.

I. The General or Mechanical Contractor shall not in any way prohibit the TAB Contractor from communicating directly and freely with the Engineer. The TAB Contractor is required to copy the Engineer on all communications to the Contractor.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.

2. Hydronic systems are filled, clean, and free of air.

3. Automatic temperature-control systems are operational.

4. Equipment and duct access doors are securely closed.

5. Balance, smoke, and fire dampers are open.

6. Isolating and balancing valves are open and control valves are operational.

7. Hydronic systems are at operating temperature.

8. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

9. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's National Standards for Total System Balance or NEBB's Procedural Standards for Testing Adjusting and Balancing of Environmental Systems, and in this section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2, Air Balancing.

B. Cut insulation and ducts for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts airtight.

2. Coordinate with the Mechanical Contractor to restore insulation, coverings, vapor barrier, and finish according to Division 23 sections.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes. Correct variations that exceed ± 10%.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Check condensate drains for proper connections.

I. Check for proper sealing of air-handling-unit components.

J. Verify that joints and seams in air duct systems are sealed as specified in Division 23 sections.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by the fan manufacturer.

1. Measure Total Airflow: Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment. Exception: Individual component measurement is not required for unitary equipment 5 tons and less in capacity. Provide external static pressure measurement across unit only.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

7. Instruct the Mechanical Contractor to replace fan and motor sheaves and belts as required to achieve design airflow or pressurization.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

4. Instruct the Mechanical Contractor to install manual volume dampers where required to achieve proper air balance.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer’s written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed ± 5%.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.

2. Check pressure in expansion tank.

3. Check makeup water-station pressure gage for adequate pressure for highest vent.

4. Check flow-control valves for specified sequence of operation, and set at indicated flow. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.

5. Set differential-pressure control valves as directed by the valve manufacturer to maintain the required downstream differential pressure.

6. Set system controls so automatic valves are wide open to heat exchangers.

7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure waterflow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer’s pump curve at zero flow and verify that the pump has the intended impeller size.

a. Impeller sizes must be adjusted to achieve pump performance, if the flow exceeds 130% of the design flow. Impeller is to be trimmed by the pump manufacturer at no additional cost to the Owner.

2. Check system resistance. With all valves open and pump at full speed, read pressure differential across the pump and mark pump manufacturer’s head-capacity curve.

a. Pumps with VFD: Adjust VFD speed until indicated waterflow is achieved.

1) Set maximum VFD output for indicated pump flow.

2) Set minimum VFD output at 18 Hz.

3) Place label on VFD stating, “Do not adjust maximum or minimum VFD speed settings. These were set by the TAB Contractor for proper pump flow on (mm/dd/yyyy).”

4) Do not use pump discharge valve to balance pumps with VFD.

b. Pump without VFD: Adjust pump discharge valve until indicated waterflow is achieved.

c. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer’s performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within ± 10% of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5% greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.

2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.

3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and system pressures and temperatures including outdoor-air temperature.

I. Measure and record the differential-pressure-control-valve settings at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Determine if the system has diversity. If the sum of the flows through the motorized control valves is greater than the flow of the pump, the system has diversity.

B. Systems without Diversity: Balance as specified above for constant volume system.

C. Systems with Diversity:

1. Compensating for Diversity:

a. When the total flow of all motorized control valves is more than the indicated flow of the pump, close a selected number of motorized control valves with the remainder of the valves fully open until the total flow of the open valves equals the indicated flow of the pump. Select the closed valves so they farthest from the pump.

b. Balance the components connected to the open valves as specified above for constant volume hydronic systems.

c. Fully open the closed control valves. Close a different group of motorized control valves until the total flow of the open valves equals the indicated flow of the pump. Select the closed valves so they are closest to the pump.

d. Balance the components connected to the open valves as specified above for constant volume hydronic systems.

2. Determine the System Differential Pressure (DP Setpoint): After balancing all the components but prior to opening the closed valves, reduce the pump speed until the flow through the most hydraulically remote valve falls to 5% below design. Increase pump speed until valve reaches design flow and record reading at system differential pressure sensor. Set the building automation system to maintain this differential pressure.

3.9 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer’s name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Efficiency rating.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Set minimum motor speed to 20%. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.10 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.11 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.

2. Waterflow rate.

3. Water pressure drop.

4. Dry-bulb temperature of entering and leaving air.

5. Wet-bulb temperature of entering and leaving air for cooling coils.

6. Airflow.

7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.

2. Airflow.

3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.

5. Calculated kilowatt at full load.

6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.

2. Airflow.

3. Air pressure drop.

4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.

3. Airflow.

4. Air pressure drop.

3.12 PROCEDURES FOR TESTING FIRE AND SMOKE CONTROL DEVICES

A. Record manufacturer and model number for each fire damper, smoke detector, smoke damper, combination fire/smoke damper, and damper actuator.

B. Confirm access door has been installed at each damper location and is properly labeled.

C. Fire Dampers:

1. Disconnect the fusible link and confirm that damper closes smoothly and completely.

2. Reset the damper and replace the fusible link.

D. Duct-Mounted Smoke Detectors:

1. Verify the proper operation of the smoke detector using a test gas, “canned smoke,” acceptable to the AHJ or Engineer. (Magnets are not acceptable.)

2. Verify activation of the smoke detector closes the appropriate smoke or combination fire/smoke damper(s) and/or de-energizes the appropriate air-moving device(s).

3. Verify activation of the smoke detector is shown by the fire alarm system where monitoring of the detector is required.

E. Smoke and Combination Fire/Smoke Dampers: Verify dampers controlled by a Total Coverage Smoke Detection System operate correctly on a signal from the system.

F. Air-Moving Device Shutdown: Verify air-moving device(s) that are to be de-energized by a Total Coverage Smoke Detection System de-energize on a signal from the system.

G. After all smoke control devices have been successfully tested, the TAB firm shall engage the services of a professional mechanical engineer, registered in the State of Arizona, to submit a signed and sealed report attesting to the proper operation of the smoke control devices and air-moving device shutdowns.

3.13 TOLERANCES

A. Set HVAC system's airflow and waterflow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: ± 10%.

2. Air Outlets and Inlets: ± 10%.

3. Heating-Waterflow Rate: ± 5%.

4. Cooling-Waterflow Rate: ± 5%.

3.14 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in the Examination article, prepare a report on the adequacy of design for system balancing devices. Recommend changes and additions to system balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.15 OUTDOOR AIR SUMMARY REPORT

A. Prepare a summary report for review by the AHJ that lists each supply-air system on the project. The report shall indicate the system or equipment designation, the scheduled outdoor-airflow rate and the balanced outdoor-airflow rate.

3.16 SPECIAL INSPECTIONS

A. Prepare special inspection reports, signed and sealed by a professional engineer, as required by the AHJ or as required above.

3.17 FINAL REPORT

A. General: Prepare certified reports in both paper and PDF format; tabulate and divide the report into separate sections for tested systems and balanced systems. Submit three copies of paper reports and one copy of report in PDF format.

1. Assemble paper reports in 3-ring binders. Separate and order sections within each binder. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab.

2. Assemble PDF report in one PDF file. Separate and order sections within the file to match the paper copy. Provide bookmarks at the first page of each section and label each bookmark with the information contained in that section. Submit on digital media acceptable to the Engineer.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.

2. Fan curves.

3. Other information relative to equipment performance; do not include shop drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB Contractor.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Certification sheet signed and sealed by the certified Testing & Balancing Engineer.

11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

12. Summary of contents including the following:

    a. Indicated versus final performance.

    b. Notable characteristics of systems.

    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.

14. Data for terminal units, including manufacturer's name, type, size, and fittings.

15. Notes to explain why certain final data in the body of reports vary from indicated values.

16. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.

    b. Conditions of filters.

    c. Cooling coil, wet- and dry-bulb conditions.

    d. Face and bypass damper settings at coils.

e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Variable frequency drive settings including maximum and minimum setpoints.

g. Inlet vane settings for variable-air-volume systems.

h. Settings for supply-air, static-pressure controller.

i. Other system operating conditions that affect performance.

17. Include a list of instruments used for procedures, along with proof of calibration.

18. Submit a preliminary, electronic copy of the final report to the Engineer for review.

19. Make any corrections noted from the Engineer's review upon receipt of comments and resubmit as required.

20. Submit the final, corrected report in electronic format to the Engineer and in both paper and electronic format to the Architect.

3.18 ADDITIONAL TESTS

A. TAB Report Verification: The TAB Specialist may be required to recheck, in the presence of the Owner's representative, specific or random selections of data recorded in the certified report. Points and areas for recheck shall be selected by the Owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for verification, specific plus random, will not exceed 10% of the total number of measurements tabulated in the report. If the values measured during the verification process exceed ± 10% of the values recorded in the report, the TAB Specialist may be required to re-perform the TAB work outlined above.

END OF SECTION

Edition 0906-0422

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SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes duct exterior insulation systems.

B. Related Sections:

1. Refer to Specification Section 23 31 13, Metal Ducts, for duct liner.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's technical data with proposed thickness and R-value indicated, and application.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to the Authorities Having Jurisdiction (AHJ). Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in the Duct Insulation Schedule article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. All materials shall conform to NFPA 90A and NFPA 90B, ASHRAE 90.1 and the International Energy Construction Code (IECC).

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket composed of aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonded Logic Ultra-Touch.

b. CertainTeed Corp.; SoftTouch Duct Wrap.

c. Johns Manville; Microlite.

d. Knauf Insulation; Atmosphere Duct Wrap.

e. Manson Insulation Products Ltd.; Alley Wrap.

f. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB with factory-applied ASJ or FSK jacket.

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

3. Products: Subject to compliance with requirements, provide one of the following:

a. Bonded Logic Ultra-Touch.

b. CertainTeed Corp.; Commercial Board.

c. Johns Manville; 800 Series Spin-Glas.

d. Knauf Insulation; Earthwool Insulation Board.

e. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below and above ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: -20 to +180°F.

3. Solids Content: ASTM D1644, 58% by volume and 70% by weight.

4. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: Aluminum.

5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: White.

2.5 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by the jacket material manufacturer.

2. Color: White.

C. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.

2. Finish and thickness are indicated in field-applied jacket schedules.

3. Moisture Barrier: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.

D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2%.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 6.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2%.

5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500%.

5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5%.

5. Tensile Strength: 34 lbf/inch in width.

2.7 SECUREMENTS

A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide, with wing seal or closed seal.

B. Stainless-Steel Bands: 0.015 inch thick, 1/2 inch wide, with wing seal or closed seal.

C. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030" thick x 2" square.

b. Spindle: Copper- or zinc-coated, low carbon-steel, or stainless-steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

c. Adhesive: Recommended by the hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Metal, Capacitor-Discharge-Weld Pin, Insulation Hangers: Copper-coated, low carbon-steel, or stainless-steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated. May be provided with base.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. Metal, Cupped-Head, Capacitor-Discharge-Weld Pins:

   a. Head: Galvanized, carbon-steel or stainless-steel sheet, minimum of 0.016 inch thick with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   b. Spindle: Copper- or zinc-coated, low carbon-steel, or stainless-steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

D. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.

E. Wire: 0.062-inch, soft-annealed stainless steel.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1" x 1" PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1" x 1" aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of the same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying the same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends below roof surface. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends inside building. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (that are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 specifications for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 specifications.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100% coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either adhesively attached or capacitor-discharge-weld pins and speed washers, or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100% coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either adhesively attached or capacitor-discharge-weld pins and speed washers, or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by the insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

1. Cross-break or slope the top of all metal jackets mounted outside the building to promote drainage and to prevent ponding of water on top of the ductwork.

3.6 DUCT INSULATION SCHEDULE

A. Duct, Plenums and Accessories Not Requiring Insulation:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1. Refer to Specification Section 23 31 13, Metal Ducts, for duct lining requirements.

2. Factory-insulated flexible ducts.

3. Factory-insulated plenums and casings.

4. Flexible connectors.

5. Vibration-control devices.

6. Factory-insulated access panels and doors.

B. Duct and Plenum Insulation: Insulate ducts and plenums in accordance with the Duct and Plenum Insulation Schedule Table.

DUCT & PLENUM INSULATION SCHEDULE TABLE					
Duct/Plenum System	Duct Type	Duct Location**	Insulation Type	Minimum Insulation Density (PCF)	Minimum Insulation R-Value (Thickness)
Supply (non-evaporative cooled)	Round	Interior, Concealed	Mineral-Fiber Blanket	0.75	R-6 (2 inches)
Supply (non-evaporative cooled)	Round	within Return Air Plenum	Mineral-Fiber Blanket	0.75	R-5 (1-1/2 inches)
Supply (non-evaporative cooled)	Rectangular	Interior, Concealed	Duct Lining*	--	--
Supply & Return (within room it serves)	Round	Interior, Exposed	None	--	--
Supply & Return (within room it serves)	Rectangular	Interior, Exposed	Duct Lining*	--	--
Supply & Return (within mechanical rooms)	Round	Interior, Exposed	Mineral-Fiber Blanket	0.75	R-6 (2 inches)
Supply & Return (within mechanical rooms)	Rectangular	Interior, Exposed	Duct Lining*	--	--
Return	Round	Interior, Concealed	Mineral-Fiber Blanket	0.75	R-6 (2 inches)
Return	Round	within Return Plenum	Mineral-Fiber Blanket	0.75	R-5 (1-1/2 inches)
Return & Exhaust	Rectangular	Interior, Concealed	Duct Lining*	--	--
Exhaust	Round	Interior, Concealed	None	--	--
Outside Air	Round/ Rectangular	Interior, Concealed or Exposed	Mineral-Fiber Blanket	0.75	R-8 (3 inches)
Air Terminal Hydronic Reheat Coil U-Bends		Interior, Concealed	Mineral-Fiber Blanket	0.75	R-6 (2 inches)

* Refer to Specification Section 23 31 13, Metal Ducts, for liner requirements.

** Interior means within the insulated building envelope.
Exterior means outside the building envelope.

3.7 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is the Contractor's option.

C. Ducts and Plenums, Concealed: None.

3.8 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is the Contractor’s option.

C. Ducts and Plenums, Concealed: None.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Stucco Embossed: 0.020 inch thick.

E. Ducts and Plenums, Exposed, Larger than 48 Inches in Diameter or with Flat Surfaces Larger than 72 Inches:

1. Aluminum, Stucco Embossed with 1-1/4-Inch-Deep Corrugations: 0.040 inch thick.

END OF SECTION

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SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes insulating the following HVAC piping systems:

1. Chilled-water and brine piping.

2. Heating hot-water piping.

3. Refrigerant piping.

4. Condensate drain piping.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's technical data with proposed thickness and R-value indicated, and application.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing and inspecting agency acceptable to the Authorities Having Jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. All insulating materials shall conform to NFPA 90A and NFPA 90B, ASHRAE 90.1 and the International Energy Construction Code (IECC).

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following manufacturers:

a. Armacell LLC.

b. K-Flex USA

G. Mineral-Fiber Insulation:

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following manufacturers:

a. CertainTeed Corp.

b. Johns Manville.

c. Knauf Insulation.

d. Manson Insulation Products Ltd.

e. Owens Corning.

2. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C1290, Type I.

3. Mineral-Fiber, Pre-Formed Pipe Insulation:

a. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Omit jacket on all but outermost layer where multiple insulation layers are required. Jacket shall comply with the following:

1) ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2) ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

H. Removable Insulation Wrap:

1. Manufacturers: Subject to compliance with requirements, provide product by the following: No Sweat.

2. Removable Insulation Wrap:

a. Insert: Mineral or glass fibers bonded with a thermosetting resin with a minimum K-factor of 0.26 suitable for use up to 450°F. Maximum flame spread index of 25 and maximum smoke developed index of 50 per ASTM E84. Insert thickness to match thickness of adjacent insulation.

b. Outer Jacket: Tychem wrap consisting of Tyvek fabric made of spunbonded polyolefin with a polyethylene coating to limit vapor permeability. Jacket shall be provided with elastic banding at the ends and a reclosable hook and loop closure system at the seam. Maximum flame spread index of 25 and maximum smoke developed index of 50 per ASTM E84.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: -20 to +180°F.

3. Solids Content: ASTM D1644, 58% by volume and 70% by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: -20 to +180°F.

3. Solids Content: 60% by volume and 66% by weight.

4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: -100 to +300°F.

5. Color: White or gray.

B. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: Aluminum.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: -40 to +250°F.

4. Color: To match jacket.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by the jacket material manufacturer.

2. Color: White.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, and mechanical joints.

C. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing, or factory cut and rolled to size.

2. Finish and thickness are indicated in field-applied jacket schedules.

3. Moisture Barrier for Indoor and Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

4. Factory-Fabricated Fitting Covers:

a. The same material, finish, and thickness as jacket.

b. Pre-formed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

c. Tee covers.

d. Flange and union covers.

e. End caps.

f. Beveled collars.

g. Valve covers.

h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2%.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500%.

5. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5%.

5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.

C. Wire: 0.062-inch, soft-annealed stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Install insulation continuously through hangers and around anchor attachments.

K. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

L. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

M. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

N. Apply adhesives, mastics, and sealants at manufacturer’s recommended coverage rate and wet and dry film thicknesses.

O. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of the same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

P. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.

Q. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

R. Repair damaged insulation facings by applying the same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

S. For above-ambient services, do not install insulation to the following:

1. Items where insulation is prohibited by the manufacturer.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends below roof surface. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends inside building. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (that are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 specifications for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 specifications for firestopping and fire-resistive joint sealers.

G. Installation of Pipe Hangers and Rollers:

1. Install thermal-hanger shield inserts complying with Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment, at all hangers and rollers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using pre-formed fitting insulation or mitered fittings made from the same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with pre-formed fitting insulation or sectional pipe insulation of the same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using pre-formed fitting insulation or sectional pipe insulation of the same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using pre-formed fitting insulation or sectional pipe insulation of the same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized pre-formed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word “union.” Match size and color of pipe labels.

10. Contractor’s Option for Valves, Strainers and Coil Connection Kits: Removable insulation wrap system.

    a. Below Ambient Systems or Where a Vapor Barrier is Specified:

        1) Provide PVC tape around ends of wrap system to seal wrap to adjacent pipe insulation.

        2) Provide PVC tape closure along seam. Center tape to overlap seam.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated and where required for maintenance. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of the same thickness as that on adjoining pipe. Install the same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in the same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section the same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pre-formed valve covers manufactured of the same material as pipe insulation when available.

2. When pre-formed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Insulation Installation on Flexible Bellow Connectors and Flexible Hoses:

1. Install full and mitered sections of pipe insulation as required.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PRE-FORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of pre-formed pipe insulation without jacket to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install pre-formed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section the same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install pre-formed sections of the same material as straight segments of pipe insulation when available.

2. When pre-formed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pre-formed sections of the same material as straight segments of pipe insulation when available.

2. When pre-formed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal seams and end joints with weatherproof sealant recommended by the insulation manufacturer or if no sealant is recommended with silicone caulk. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable pre-formed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is the Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on pre-insulated underground piping.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Chilled Water, Above 40°F:

1. Insulation shall have a maximum K-factor of 0.27 at a mean rating temperature of 75°F and be one of the following:

a. Flexible Elastomeric: 1/2 inch thick for piping less than 1-1/2 inches; 1 inch thick for piping 1-1/2 inches and larger.

b. Mineral-Fiber, Pre-Formed Pipe, Type I: 1/2 inch thick on piping less than 1-1/2 inches; 1 inch thick for piping 1-1/2 inches and larger.

B. Heating-Hot-Water Supply and Return, 200°F and Below:

1. Mineral-Fiber, Pre-Formed Pipe, Type I with a Maximum K-factor of 0.29 at a Mean Rating Temperature of 125:

a. 1-1/2 inches thick for pipe smaller than 1-1/2 inches; 2 inches thick for pipe 1-1/2 inches and larger.

C. Refrigerant Suction Piping:

1. Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.

b. Mineral-Fiber, Pre-Formed Pipe Insulation: 1 inch thick.

D. Refrigerant Suction Flexible Tubing: Flexible elastomeric, 1 inch thick.

E. Air Conditioning Condensate Drain Piping: Flexible elastomeric, 3/4 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water, Above 40°F:

1. Insulation shall have a maximum K-factor of 0.27 at a mean rating temperature of 75°F and be one of the following:

a. Flexible Elastomeric: 1 inch thick for piping less than 1-1/2 inches; Do not use on piping 1-1/2 inches and larger.

b. Mineral-Fiber Pre-Formed, Type I: 1 inch thick for pipe less than 1-1/2 inches; 1-1/2 inches thick for piping 1-1/2 inches and larger.

B. Heating-Hot-Water Supply and Return, 200°F and Below:

1. Mineral-Fiber, Pre-Formed Pipe Insulation, Type I with a Maximum K-factor of 0.29 at a Mean Rating Temperature of 125:

a. 2 inches thick for pipe smaller than 1-1/2 inches; 2-1/2 inches thick for pipe 1-1/2 inches and larger.

C. Refrigerant Suction Piping: Flexible elastomeric, 1 inch thick.

D. Refrigerant Suction Flexible Tubing: Flexible elastomeric, 1 inch thick.

E. Air Conditioning Condensate Drain Piping: Flexible elastomeric, 3/4 inch thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is the Contractor’s option or as directed on the drawings.

C. Piping, Concealed: None.

D. Piping, Exposed:

1. PVC: 30 mils thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is the Contractor’s option.

C. Piping, Concealed: None.

D. Piping, Exposed:

1. Aluminum, Corrugated or Stucco Embossed: 0.020 inch thick.

END OF SECTION

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SECTION 23 09 00

BUILDING AUTOMATION SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes control equipment for HVAC systems and components.

B. The Building Automation System (BAS) Contractor is responsible for the complete installation of this system as necessary to provide the sequence of operations, and monitor and control the equipment and points as shown on the drawings. The complete installation includes all required 120-volt wiring, all low-voltage wiring, and communication wiring. Refer to Specification Section 23 05 20, Electrical and Control Wiring for Mechanical Systems, for requirements.

1.2 SUBMITTALS

A. Product Data: For the complete BAS indicated and intended for this project. Include the following as a minimum:

1. Sequence of operations intended for each system component on this project.

2. Copy of each graphic screen intended for this project.

3. Operator workstation and all associated components.

4. All control hardware including controllers, panels, sensors, thermostats, valves, dampers, etc., intended for this project. Include the following:

a. Manufacturer and model number.

b. Equipment dimensions.

c. Required clearances.

d. Electrical Data:

1) Amperage.

2) Voltage/Phase/Hz.

3) Electrical service point(s) of connection.

e. Materials of construction.

f. Accessories and options.

5. Point chart for each system component intended for this project.

6. Power, signal, and control wiring diagrams.

7. Damper schedule.

8. Valve schedule.

B. Software and firmware operational documentation.

C. Field quality-control test reports.

D. Warranty information.

E. Operation and maintenance data: Include the following:

1. Table of contents.

2. As-Builts of the system showing all points and terminations in both AutoCAD and hardcopy format.

3. Manufacturer's product data for each item installed.

4. System operator's manuals.

5. Electronic backup copy of site-specific programming, databases, and sequences.

6. Network diagrams.

7. Wiring termination schedules.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction (AHJ), and marked for intended use.

B. The BAS Contractor shall be a recognized distributor, manufacturer's representative, or wholesaler of a national manufacturer of Building Automation Systems.

C. The BAS Contractor shall have a facility within Arizona supplying complete maintenance and support services on a 24-hour, 7-day-a-week basis. This support facility shall have spare parts and all necessary test and diagnostic equipment required to install, commission, and service the specified BAS.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which the manufacturer agrees to repair or replace components of the BAS that fail in materials or workmanship within specified warranty period.

1. Extended warranties include, but are not limited to, the following:

a. Reprogramming of sequences and updating graphics.

b. Parts and labor.

2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:

1. Alerton Inc.

2. Automated Logic Corporation.

3. Circon by Efficient Building Automation Corporation.

4. Delta Controls.

5. Distech Controls, Inc.

6. Honeywell International Inc.; WEBS Compatible

7. Johnson Controls, Inc.; Controls Group.

8. KMC Controls.

9. Reliable Controls Corporation.

10. Siemens Building Technologies, Inc.

11. Tridium, Inc.

B. Communications between the operator workstation and network control units shall use BACnet protocol.

C. Communications between the network controllers and DDC controllers shall use BACnet protocol.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multi-user, multi-tasking environment and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 SOFTWARE

A. The software operating the BAS shall provide the following features:

1. Downloading and Uploading:

    a. Provide the capability to generate BAS software-based sequences, database items and associated operational definition information and user-required revisions to any Operator Workstation (OWS) and the means to download the same to the associated application node.

    b. Application software tool used for the generation of custom logic sequences shall be resident in both the application node and the OWS.

2. Graphics:

    a. Provide graphics to allow for monitoring and control of each piece of equipment on the project.

    b. Graphics shall include clickable site plans, floor plans, etc., showing the actual location of each piece of equipment.

    c. Floor plans shall use color-coding to indicate areas or items in alarm or not meeting the desired temperature setpoint.

    d. Dynamic graphics shall be provided for each piece of equipment showing real-time operating data and allowing modification of adjustable parameters.

3. Schedules:

    a. The system shall provide multiple schedule input forms for automatic time-of-day scheduling and override scheduling of BAS operations. At a minimum, the following spreadsheet types shall be accommodated:

        1) Weekly schedules.

        2) Temporary override schedules.

        3) Special “Only Active If Today Is a Holiday” schedules.

        4) Monthly schedules.

    b. Schedules shall be provided for each system or sub-system in the BAS. Each schedule shall include all commandable points residing within the system. Each point may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.

    c. Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

4. Alarms:

a. Alarms shall be routed directly from primary application nodes to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the OWS software shall, at the minimum, provide the following functions:

1) Log date and time of alarm occurrence.

2) Generate a “pop-up” window, with audible alarm, informing a user that an alarm has been received.

3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

5) Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop-up window described above. Systems which use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.

6) Any attribute of any object in the system may be designated to report an alarm.

b. The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

c. The BAS shall annunciate application alarms at minimum.

5. Reports:

a. Reports shall be generated and directed to one or more of the following: User interface displays, printers, or archive at the user’s option. As a minimum, the system shall provide the following reports:

1) All points in the DDC System.

2) All points in each DDC System application.

3) All points in a specific application node.

4) All points in a user-defined group of points.

5) All points currently in alarm in a DDC System application.

6) All points locked out in a DDC System application.

7) All DDC System schedules.

8) All user defined and adjustable variables, schedules, interlocks and the like.

9) DDC System diagnostic and system status reports.

6. Historical Trending and Data Collection:

a. Trend and store point history data for all BAS points and values as selected by the user.

b. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.

c. At a minimum, provide the capability to perform statistical functions on the historical database:

1) Average.

2) Arithmetic mean.

3) Maximum/minimum values.

4) Range - difference between minimum and maximum values.

5) Standard deviation.

6) Sum of all values.

7) Variance.

7. Application Routines:

a. Event Messaging: Provide for the automatic execution of user-defined messages on the occurrence of each predefined BAS real-time event including equipment/point status change, approaching limit or alarm, time of day and the like. Direct messages to any number of operator PCs, e-mail destinations, and pagers.

b. Indoor Air Quality: Provide monitoring of outside air, return air and supply air CO2 concentration, calculate and maintain fresh air requirements. Adjust outdoor air intake to ensure return air CO2 high level limit is not exceeded.

c. Optimum Start/Stop: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions, to determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.

d. Auto Alarm Lockout: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, fire alarm and the like.

e. Energy Monitoring: Provide software to monitor and totalize consumption as measured by pulse meters.

f. Event Initiated Programs and Custom Logic: Provide software to define custom logic sequences that will reside in the nodes. The definition software will also reside in the node and be accessible via the standard user interface via a browser.

g. System Restart: Upon restoration of the AC power to an HVAC Node, automatically restart all equipment and restore all loads to the state as required by the BAS. Provide appropriate time delays to prevent demand surges or overload trips.

h. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during startup periods by automatically introducing time delays between successive start commands to heavy electrical loads.

i. Runtime Totalization: Automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.

j. Analog/Pulse Totalization: Sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

2.4 DDC EQUIPMENT

A. Operator Workstation (OWS): PC-based microcomputer with minimum configuration as follows:

1. Motherboard: With integrated USB ports, Ethernet network port, audio, bios, and hardware monitoring.

2. Processor: Minimum Intel Pentium.

3. Random-Access Memory: 4 GB.

4. Graphics: Discrete video adapter, minimum 1,600 x 1,200 pixels, minimum 512-MB video memory, with TV out.

5. Monitor: Minimum 19 inches, LCD color.

6. Keyboard: QWERTY, 105 keys in ergonomic shape.

7. Hard-Disk Drive: Minimum 500 GB.

8. Mouse: Three button, optical.

9. Uninterruptible Power Supply: Minimum of 2 kVa.

10. Operating System: Latest version of Microsoft Windows.

B. Web Access Server:

1. Provide a web access server to allow users to observe, access, and modify setpoints, scheduling data, operating conditions, alarms, and reports; and save any changes made to the system.

2. Access shall be allowed via any internet connected computer with a standard web browser when the proper password is given.

3. The system information shall be provided using the same style of graphics used at the main operator interface.

C. Network Control Units: Modular, comprising processor board with programmable, non-volatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.

2. Standalone mode control functions operate regardless of connection to operator station. Functions include the following:

a. Global communications.

b. Discrete/digital, analog, and pulse I/O.

c. Monitoring, controlling, or addressing data points.

d. Software applications, scheduling, and alarm processing.

e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

D. Local Control Units: Modular, comprising processor board with electronically programmable, non-volatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

2. Standalone mode control functions operate regardless of connection to network control unit. Functions include the following:

a. Discrete/digital, analog, and pulse I/O.

b. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of On-Off signals without external power.

2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.

3. Analog Inputs: Allow monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals.

4. Binary Outputs: Provide On-Off or pulsed low-voltage signal, selectable for normally-open or normally-closed operation with three-position (On-Off-Auto) override switches and status lights.

5. Analog Outputs: Provide modulating signal, either low-voltage (0 to 10 VDC) or current (4 to 20 mA) with status lights, two-position (Auto-Manual) switch, and manually adjustable potentiometer.

6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.

7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80% of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.

2. Combined 1% line and load regulation with 100-mic.sec. response time for 50% load changes.

3. Built-in overvoltage and overcurrent protection and be able to withstand 150% overload for at least 3 seconds without failure.

G. Uninterruptible Power Supply (UPS):

1. Where indicated for supporting operator PCs, servers, and other equipment as indicated, provide a UPS.

2. UPS shall be sized for 50% spare capacity. The UPS shall be complete with batteries, external bypass and line conditioning.

H. Power Fail/Auto Restart:

1. Provide for the automatic orderly and predefined shutdown of parts or all of the BAS following total loss of power to parts or all of the BAS.

2. Provide for the automatic orderly and predefined startup of parts or all of the BAS following total loss of power to those parts or all of the BAS. Archive and annunciate time and details of restoration.

3. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.

4. Maintain the BAS real-time clock operation during periods of power outage for a minimum of 72 hours.

2.5 UNITARY CONTROLLERS

A. Unitized, capable of standalone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; and non-volatile memory for program storage and bios.

2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.

3. Enclosure: Dustproof rated for operation at 32 to 120°F.

2.6 ANALOG CONTROLLERS

A. Step Controllers: 6-stage or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable setpoint, scale range -10 to +70°F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55% and On-Off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.7 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

THERMISTORS ARE THE MOST COMMON TYPE OF SENSOR AS THEY ARE COST-FRIENDLY AND HAVE A TEMPERATURE RANGE BETWEEN ROUGHLY -70°F AND 400°F WHICH WILL WORK IN MOST HVAC APPLICATIONS.

B. Thermistor Temperature Sensors and Transmitters:

1. Accuracy: ± 0.5°F at calibration point.

2. Wire: Twisted, shielded-pair cable.

3. Insertion Elements in Ducts: Single point, 18 inches long maximum or shorter as required to be centered within the duct; use where not affected by temperature stratification or where ducts are smaller than 9 sq.ft.

4. Averaging Elements in Ducts: 36 inches long minimum, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq.ft.

5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

6. Room Sensor: Wall box or surface mounting with the following features where indicated:

   a. Override button.

   b. LCD display for room temperature and setpoint.

   c. Setpoint adjustment device to provide ± 3 degree (adjustable) range.

   d. Color: White unless noted otherwise.

7. Room Security Sensors: Wall box mounting, stainless-steel cover plate with insulated back and security screws.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight or on the north side of building.

RTDS ARE MORE EXPENSIVE BUT HAVE A TEMPERATURE RANGE BETWEEN ROUGHLY -330°F AND 1,200°F. THESE SHOULD ONLY BE USED FOR HVAC APPLICATIONS WITH EXTREME OPERATING TEMPERATURES. INDICATE ON DRAWINGS OR IN THE SPECIFICATION WHERE THEY SHOULD BE USED.

C. Humidity Sensors: Bulk polymer sensor element.

1. Accuracy: 5% full range with linear output.

2. Room Sensor Range: 20 to 80% relative humidity.

3. Room Sensor: Wall box or surface mounting with the following features where indicated:

   a. LCD display for room humidity and setpoint.

   b. Color: White unless noted otherwise.

4. Room Security Sensors: Wall box mounting, stainless-steel cover plate with insulated back and security screws.

5. Duct Sensor: 20 to 80% relative humidity range with element guard and mounting plate.

6. Outside-Air Sensor: 20 to 80% relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120°F.

7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100% relative humidity.

D. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.

    a. Accuracy: 2% of full scale with repeatability of 0.5%.

    b. Output: 4 to 20 mA.

    c. Building Static-Pressure Range: 0 to 0.25-inch wg.

    d. Duct Static-Pressure Range: 0 to 5-inch wg.

2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300 psig; linear output 4 to 20 mA.

4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

5. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

E. Combination Air Flow, Pressure, and Temperature Sensor:

1. Basis of Design: HTx104-PE manufactured by Ebtron, Inc. or comparable product with prior approval.

2. Combination sensor to provide airflow, pressure and air temperature with remote mounted transmitter.

3. Sensor shall contain two hermetically sealed bead-in-glass thermistors. Sensor shall provide bidirectional airflow, bidirectional pressure, and temperature to the transmitter.

4. The transmitter shall equally weigh and average the airflow, pressure and temperature of the sensor prior to output along with system status, configuration settings and diagnostics.

5. Operating Range: 0 to ± 3,000 FPM.

6. Accuracy: 2% of full scale for airflow, 0.14°F between -20°F and +160°F for temperature.

7. Sensor and cable shall be plenum rated.

F. Room Sensor: Wall box or surface mounting with the following features:

1. Color: White unless noted otherwise.

2. Room sensor accessories include the following:

    a. Insulating Bases: For sensors located on exterior walls.

b. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base, or metal wire, tamperproof, or locking, solid metal, ventilated as indicated on the drawings.

c. Adjusting Key: As required for calibration and cover screws.

G. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.8 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0 to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175% of rated motor current.

D. Voltage Transmitter (100 to 600 VAC): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1% full-scale accuracy.

E. Power Monitor: Three-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4 to 20 mA kW output, with maximum 2% error at 1.0 power factor and 2.5% error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2 to 10 VDC, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.9 GAS DETECTION EQUIPMENT

A. Carbon Monoxide Detectors: Single or multi-channel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104°F; with two factory-calibrated alarm levels at 50 and 100 ppm.

B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130°F and calibrated for 0 to 2%, with continuous or averaged reading, 4 to 20 mA output; for wall mounting.

2.10 THERMOSTATS

A. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.

2. Preferential rate control to minimize overshoot and deviation from setpoint.

3. Set up for four separate temperatures per day.

4. Instant override of setpoint for continuous or timed period from 1 hour to 31 days.

5. Short-cycle protection.

6. Programming based on every day of the week.

7. Selection features include degree F or degree C display, 12 or 24-hour clock, keyboard disable, remote sensor, and fan On-Auto.

8. Battery replacement without program loss.

9. Thermostat display features include the following:

    a. Time of day.

    b. Actual room temperature.

    c. Programmed temperature.

    d. Programmed time.

    e. Duration of timed override.

    f. Day of week.

    g. System mode indications include “Heating,” “Off,” “Fan Auto,” and “Fan On.”

B. Remote-Bulb Thermostats: On-Off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of the same material as bulb.

2. Bulbs in air ducts with flanges and shields.

3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.

4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.

5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.

6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

C. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable setpoint.

D. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable setpoint in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

E. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint.

1. Bulb Length: Minimum 20 feet.

2. Quantity: One thermostat for every 20 sq.ft. of coil surface.

F. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint.

1. Bulb Length: Minimum 20 feet.

2. Quantity: One thermostat for every 20 sq.ft. of coil surface.

G. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.11 HUMIDISTATS

A. Duct-Mounting Humidistats: Electric insertion, two-position type with adjustable, 2% throttling range, 20 to 80% operating range, and single- or double-pole contacts.

2.12 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Manufacturer: Belimo Automation AG.

2. Comply with requirements in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

3. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Non-Spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.

5. Spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.

6. Non-Spring-Return Motors for Dampers Larger than 25 Sq.Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.

7. Spring-Return Motors for Dampers Larger than 25 Sq.Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturer: Belimo Automation AG.

2. Valves: Size for torque required for valve close off at maximum pump differential pressure.

3. Dampers: Size for running torque calculated as follows:

a. Parallel-Blade Damper with Edge Seals: 7 inch-lbs./sq.ft. of damper.

b. Opposed-Blade Damper with Edge Seals: 5 inch-lbs./sq.ft. of damper.

c. Parallel-Blade Damper without Edge Seals: 4 inch-lbs./sq.ft. of damper.

d. Opposed-Blade Damper without Edge Seals: 3 inch-lbs./sq.ft. of damper.

e. Dampers with 2 to 3-Inch wg of Pressure Drop or Face Velocities of 1,000 to 2,500 fpm: Increase running torque by 1.5.

f. Dampers with 3 to 4-Inch wg of Pressure Drop or Face Velocities of 2,500 to 3,000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.

5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.

6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.

7. Power Requirements (Two-Position Spring Return): 24 or 120 VAC.

8. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 W at 24 VDC.

9. Proportional Signal: 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.

10. Temperature Rating: -22 to +122°F.

11. Temperature Rating (Smoke Dampers): -22 to +250°F.

12. Run Time: 12 seconds open, 5 seconds closed.

2.13 CONTROL VALVES

A. Control Valve General Requirements: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. Control valves shall be pressure independent (PICV), unless otherwise indicated.

B. Pressure Independent Control Valves (PICV):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong Pumps, Inc.

   b. Belimo Aircontrols.

   c. Bell & Gossett Domestic Pump; a Division of ITT Industries.

   d. Danfoss.

   e. Hays Fluid Controls.

   f. Oventrop.

   g. Tour & Andersson.

2. Description: Combination motorized control valve with integral pressure regulator or electronic flow meter to limit maximum flow and maintain desired flow at varying system differential pressures.

3. Pressure Capabilities:

   a. Minimum valve operating pressure shall be 5 psig or less.

   b. Maximum valve differential pressure shall be 200 psig or greater.

4. NPS 2 and Smaller:

   a. Body: Bronze or Ametal®, characterized ball or globe style with calibrated orifice or venturi.

   b. Ball: Chrome-plated brass or stainless steel.

   c. Plug: Resin.

   d. Seat: PTFE or Ametal®.

   e. End Connections: Threaded or socket.

   f. Pressure Gage Connections: Integral seals for portable differential pressure meter.

   g. CWP Rating: Minimum 125 psig.

   h. Maximum Operating Temperature: 250°F.

5. NPS 2-1/2 and Larger:

   a. Body: Cast-iron, ductile-iron or steel body, characterized ball, plug or globe style with calibrated orifice or venturi.

b. Ball: Brass or stainless steel.

c. Stem Seals: EPDM O-rings.

d. Disc: Glass and carbon-filled PTFE.

e. Seat: PTFE or ductile iron.

f. End Connections: Flanged or grooved.

g. Pressure Gage Connections: Integral seals for portable differential pressure meter.

h. CWP Rating: Minimum 125 psig.

i. Maximum Operating Temperature: 250°F.

6. Pressure Regulator:

a. Brass or stainless-steel cartridge and housing.

b. Stainless-steel spring.

c. Reinforced-polymer or EPDM diaphragm.

7. Electronic Flow Meter:

a. Electromagnetic type powered by the valve actuator.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.

b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:

a. Two Position: Line size.

b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.

c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system (pump) head for two-way valves and 100% of pressure differential across valve or 100% of total system (pump) head.

D. Hydronic system characterized ball valves shall have the following characteristics:

1. NPS 3 and Smaller: Forged brass body rated for 400 psi, stainless-steel ball with blowout-proof stem, fiberglass-reinforced PTFE seats, dual EPDM O-ring packing, stainless-steel characterizing disk.

2. NPS 2-1/2 through NPS 6: Class 125 cast-iron body, stainless-steel ball with blowout-proof stem, fiberglass-reinforced PTFE seats, dual EPDM O-ring packing, stainless-steel characterizing disk, and flanged ends.

3. Sizing: 5-psig maximum pressure drop at design flow rate or the following:

a. Two Position: Line size.

b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.

c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

5. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system (pump) head for two-way valves and 100% of pressure differential across valve or 100% of total system (pump) head.

E. Butterfly Valves: 150-psig maximum pressure differential, ASTM A126 cast-iron or ASTM A536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Disc Type: Nickel-plated ductile iron.

2. Sizing: 1-psig maximum pressure drop at design flow rate.

F. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250°F operating conditions.

2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.

3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

G. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250°F operating conditions.

2. Thermostatic Operator: Liquid-filled integral sensor with integral adjustable dial.

2.14 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Specification Section 23 05 20, Electrical and Control Wiring for Mechanical Systems.

PART 3 - EXECUTION

3.1 ROOM SENSOR APPLICATION SCHEDULE

A. Furnish the room sensor listed below unless indicated otherwise. Install where indicated on the drawings.

1. Room Security Sensor: Public areas such as corridors, restrooms, etc., where the occupants are transient in nature and not permitted to adjust the room temperature.

2. Room Sensor: Storage rooms, commercial kitchens, back-of-house areas, gymnasiums, shop areas, warehouses, etc., where occupants are transient or not permitted to adjust room setpoints. Provide wire guards where sensors may be exposed to mechanical damage due to activities within the area and as indicated.

3. Room Sensor with Display, Override Button, Setpoint Adjustment: Private offices, open office areas, meeting rooms, conference rooms, reception areas provided with a reception desk, etc., where occupants are permitted to override the occupied/unoccupied mode, and adjust the room setpoints.

3.2 FURNISH

A. Furnish motorized isolation valves and motorized control valves to the Mechanical Contractor for installation into the piping systems and coordinate mounting locations.

B. Furnish thermowells and instrument wells to the Mechanical Contractor for installation in the piping systems and coordinate mounting locations.

C. Furnish flow meter installation requirements and coordinate mounting locations and methods with the Mechanical Contractor.

3.3 COORDINATION

A. Coordinate control damper styles, sizes, and mounting locations with Mechanical Contractor.

3.4 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation. Install devices at an elevation per ADA Requirements.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

C. Install labels and nameplates to identify control components according to Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

D. Install electronic and fiber-optic cables according to Specification Section 23 05 20, Electrical and Control Wiring for Mechanical Systems.

E. Install combination airflow, pressure, and temperature sensors for measuring underfloor plenum temperature and pressure where indicated on the drawings. Install each sensor in a floor diffuser that has been sealed to prevent the migration of air from the underfloor plenum.

3.5 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, cabinets building wire, cable, signal, and communication cable according to Specification Section 23 05 20, Electrical and Control Wiring for Mechanical Systems.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway.

3. Install concealed cable in raceway.

4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.

5. Within control cabinets, fasten flexible conductors, bridging cabinets, and doors along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

B. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

C. Connect Hand-Off-Auto selector switches to override automatic interlock controls when switch is in Hand position.

3.6 PROGRAMMING

A. Common Routines: Use the same programming routine for common pieces of equipment within the same building and on the same campus.

B. Floor Plans: Prepare floor plans based on the most up-to-date architectural floor plans. Room names and numbers shall match those used in the field which may differ from those contained in the drawings.

C. Equipment Locations: Adjust equipment locations to match actual field conditions. This includes VAV box locations, temperature sensor and thermostat locations, etc.

D. Zoning: Adjust HVAC unit zoning to match actual field conditions.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust central plant optimization controllers and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

2. Test and adjust controls and safeties.

3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

4. Test each point through its full operating range to verify that safety and operating control setpoints are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

6. Test each system for compliance with sequence of operation.

7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.

2. Check instruments for proper location and accessibility.

3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

4. Check instrument tubing for proper fittings, slope, material, and support.

5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.

6. Check temperature instruments and material and length of sensing elements.

7. Check control valves. Verify that they are in correct direction.

8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.

9. Check DDC System as follows:

   a. Verify that DDC controller power supply is from emergency power supply, if applicable.

   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.

   c. Verify that spare I/O capacity has been provided.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.8 COMMISSIONING

A. Commission all functions of the BAS.

B. Acceptance Check Sheet:

1. Prepare a check sheet that includes all points for all functions of the BAS.

2. Submit the check sheet to the Engineer for approval 1 month prior to testing.

3. Complete the check sheet for all items and functions of the BAS and initial each entry with time/date as record of having fully calibrated and tested the BAS. Submit to the Engineer.

4. The Engineer will use the check sheet as the basis for acceptance testing with the BAS Contractor.

C. Provide all necessary specialist labor, materials, and tools to demonstrate to the Engineer that the BAS has been commissioned and is operating in compliance with the Contract. Prepare a list of noted deficiencies signed by both the Engineer and the BAS Contractor.

D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

3.9 TRAINING

A. The BAS Contractor shall provide the following training services:

1. One 8-hour day of onsite orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project As-Built Drawings, the DDC System software layout and naming conventions, and a walkthrough of the facility to identify panel and device locations.

2. Factory training for one Owner’s representative in a factory training lab. This training shall be performed by a factory-certified professional trainer and, at a minimum, shall consist of:

a. Two 8-hour days training covering basic system operation.

b. One 8-hour day training covering system reporting and alarm management.

c. One 8-hour day training of scheduling and point trending.

END OF SECTION

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SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.

2. Chilled-water piping.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 125 psig at 200°F.

2. Chilled-Water Piping: 125 psig at 100°F.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's product literature indicating materials of construction, ratings, options and accessories for each type of the following:

1. Pipe and fittings.

2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves, automatic flow-control valves, reduced-pressure-principle backflow preventers.

3. Air control devices.

4. Hydronic specialties.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, Building Services Piping, for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: Use the following types and grades. Wall thickness is indicated in Part 3 Piping Applications article. Standard weight may be substituted for Schedule 40.

1. NPS 2 and Smaller: ASTM A106, Type S (seamless), Grade B, black steel, plain ends.

2. NPS 2-1/2 through NPS 12: ASTM A53, Type E (electric-resistance welded), Grade B, black steel, plain ends.

3. NPS 4 and Larger: ASTM A53, Type E (electric-resistance welded), Grade B, black steel, plain ends.

4. Provide hot-dipped zinc coating where required.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 Piping Applications article. Provide hot-dipped zinc coated as required to match adjacent piping.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 Piping Applications article. Provide hot-dipped zinc coated as required to match adjacent piping.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 Piping Applications article. Provide hot-dipped zinc coated as required to match adjacent piping.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 Piping Applications article. Provide hot-dipped zinc coated to as required to match adjacent piping.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, hot-dipped zinc coating as required to match adjacent piping, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.

G. Wrought-Steel Fittings: Factory-fabricated ASME B16.9 fittings with beveled ends for butt welding. Match schedule of connected pipe. Use long radius elbows except where space requires short radius elbows.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, non-metallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Dielectric Nipples: Galvanized- or electroplated-steel, or ductile iron nipple with inert and non-corrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

B. Copper Flange Adapters: Two-part assembly consisting of a powder coated steel flange complying with ANSI B16.5 with an EPDM insulator adhered to the steel flange and extending through the inside of the opening to prevent contact between the copper insert and the flange. The copper insert shall have a solder end complying with ANSI B16.22.

2.5 VALVES

A. Check, Ball, and Butterfly Valves: Comply with requirements specified in Specification Section 23 05 23, General Duty Valves for HVAC Hydronic Piping.

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Specification Section 23 09 00, Building Automation System for HVAC.

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pumps, Inc.

b. NIBCO.

c. Oventrop.

d. Red-White Valve Corp.

e. Tour & Andersson; available through Victaulic Company.

2. Body: Bronze or Ametal®, multi-turn plug or globe type with calibrated orifice or venturi.

3. Plug: Resin.

4. Seat: PTFE or Ametal®.

5. End Connections: Threaded or socket.

6. Pressure Gage Connections: Integral seals for portable differential pressure meter with one port on each side of valve seat or calibrated orifice.

7. Handle Style: Handwheel with memory stop to retain set position.

8. CWP Rating: Minimum 125 psig.

9. Maximum Operating Temperature: 250°F.

D. Cast-Iron, Ductile-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pumps, Inc.

b. Bell & Gossett Domestic Pump; a Division of ITT Industries.

c. NIBCO.

d. Oventrop.

e. Tour & Andersson; available through Victaulic Company.

2. Body: Cast-iron, ductile-iron or steel body, multi-turn plug or globe pattern with calibrated orifice or venturi.

3. Stem Seals: EPDM O-rings.

4. Disc: Glass and carbon-filled PTFE.

5. Seat: PTFE or ductile iron.

6. End Connections: Flanged or grooved.

7. Pressure Gage Connections: Integral seals for portable differential pressure meter with one port on each side of valve seat or calibrated orifice.

8. Handle Style: Handwheel with memory stop to retain set position.

9. CWP Rating: Minimum 125 psig.

10. Maximum Operating Temperature: 250°F.

E. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Griswold Controls.

b. Hays Fluid Controls.

c. NIBCO.

d. Tour & Andersson AB.

2. Body: Brass or ferrous metal.

3. Piston and Spring Assembly: Stainless steel, tamperproof, self-cleaning, and removable.

4. Combination Assemblies: Include bronze or brass-alloy ball valve.

5. Identification Tag: Marked with zone identification, valve number, and flow rate.

6. Size: The same as pipe in which installed.

7. Performance: Maintain constant flow, ± 5% over system pressure fluctuations.

8. Minimum CWP Rating: 175 psig.

9. Maximum Operating Temperature: 200°F.

F. Differential Pressure Control Valve: Pilot-operated valve to maintain an adjustable differential pressure in a hydronic piping zone.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Oventrop.

b. Tour & Andersson AB.

2. Differential Pressure Control Valve:

a. Body: Ametal® or cast iron.

b. Bonnet, Cone, Spindles: Ametal®.

c. Stem Seals: EPDM O-rings.

d. O-Rings: EPDM rubber.

e. Membrane: Reinforced EPDM or HNBR rubber.

f. Spring: Stainless steel.

g. End Connections: Threaded or flanged.

h. Pressure Gage Connections: Integral seals for portable differential pressure meter.

i. Handle Style: Plastic handwheel, with memory stop to retain set position.

j. CWP Rating: Minimum 125 psig.

k. Maximum Operating Temperature: 250°F.

3. Balancing Valve:

a. Body: Cast- or ductile-iron globe pattern with calibrated orifice or venturi.

b. Bonnet: Ametal® or ductile-iron.

c. Cone: Ametal®, bronze, or brass.

d. Spindle: Ametal®.

e. Seat Seals: EPDM O-rings.

f. End Connections: Threaded or flanged.

g. Pressure Gage Connections: Integral seals for portable differential pressure meter.

h. Handle Style: Plastic handwheel, with memory stop to retain set position.

i. CWP Rating: Minimum 125 psig.

j. Maximum Operating Temperature: 250°F.

4. Interconnection Tubing: Copper tube.

2.6 HYDRONIC PIPING SPECIALTIES

A. Temperature and Pressure Test Ports (Pete's Plug): Solid brass fitting with two valve cores of Nordel and a solid brass cap with retainer strap designed to allow for the insertion of a pressure gauge or thermometer into the piping system. Test port shall be suitable for use at pressures up to 500 psi and fluid temperatures up to 275°F. Select test port length to extend through piping insulation.

B. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.

   b. Armstrong Pumps, Inc.

   c. Bell & Gossett ITT; Division of ITT Fluid Technology Corp.

   d. Griswold Controls.

   e. Mueller Steam Specialty.

   f. Spirax Sarco Inc.

2. Body: Bronze with threaded gasketed cover and bottom drain connection, or ASTM A126, Class B, cast iron or ductile iron with bolted cover and bottom drain connection.

3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

4. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50% free area.

5. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flex-Hose Co., Inc.

   b. Flexonics.

   c. Metraflex.

   d. Twin City Hose.

2. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.

3. End Connections: Threaded or flanged to match equipment connected.

4. Performance: Capable of 3/4-inch misalignment.

5. CWP Rating: 150 psig.

6. Maximum Operating Temperature: 250°F.

D. Water Meter:

1. AWWA C700, oscillating-piston or nutating disc, magnetic-drive, totalization meter.

2. Body: Bronze.

3. Maximum Pressure Loss at Design Flow: 3 psig.

4. Registration: Gallons or cubic feet.

5. Controls: Flow-control switch with normally-open contacts; rated for maximum 10 A, 250 VAC; and that will close at adjustable increments of total flow.

6. Meter shall match size of adjacent piping.

E. Expansion fittings are specified in Specification Section 23 05 16, Expansion Fittings and Loops for HVAC Piping.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each building entrance and exit, at each supply and return connection to each piece of equipment, and upstream and downstream of each strainer.

B. Install calibrated-orifice, multi-turn manual balancing valves in the return pipe of each heating or cooling terminal. Manual balancing valves may be omitted where pressure independent control valves are provided.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drain piping to nearest floor sink or as indicated on the drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

F. Install reduced-pressure-principle backflow preventers at the connection between the domestic cold water system and the hydronic systems.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Do not install hydronic piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe supplying equipment serving the room. Maintain all required clearances to other equipment.

E. Do not install piping above electrical equipment such as transformers, panels, motor control centers, etc., in other rooms.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction.

K. Install fittings for branch connections with three elbow loops for thermal expansion and contraction.

L. Install piping to allow application of insulation.

M. Select system components with pressure rating equal to or greater than system operating pressure.

N. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

O. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains, at building entrance and exit, and elsewhere as required for system drainage.

P. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

Q. Make branch connections to mains using flow tees where branch size is not less than one-third the diameter of the main. Weld-O-Lets and Thread-O-Lets, may be used in other applications. Hot-taps shall only be used to connect branch lines to live mains.

R. Unless otherwise indicated, install branch connections to mains with the branch connected to the top or side of the main pipe.

S. Install valves according to Specification Section 23 05 23, General Duty Valves for HVAC Hydronic Piping.

T. Install motorized valves furnished by the Controls Contractor according to Specification Sections 23 05 23, General Duty Valves for HVAC Hydronic Piping, and 23 09 00, Building Automation System for HVAC.

U. Install thermowells furnished by the Controls Contractor where directed.

V. Install unions in piping, NPS 2 and smaller at final connections of equipment, and elsewhere as indicated.

W. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

X. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2. Install strainers with strainer basket facing downward to facilitate cleaning and blowdown.

Y. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Specification Section 23 05 16, Expansion Fittings and Loops for HVAC Piping.

Z. Identify piping as specified in Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

AA. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Specification Section 23 05 17, Sleeves and Sleeve Seals for HVAC Piping. Do not install piping within concrete.

BB. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Specification Section 23 05 17, Sleeves and Sleeve Seals for HVAC Piping. Do not install piping within concrete.

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Specification Section 23 05 18, Escutcheons for HVAC Piping.

DD. Remove construction debris, dust, dirt, and other foreign material from piping systems as work progresses. Protect pipe openings during construction.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment. Comply with the following requirements for maximum spacing of supports.

B. Vibration isolation devices are specified in Specification Section 23 05 48.13, Vibration Controls for HVAC Piping and Equipment.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

5. Wrap copper piping with not less than two layers of 10-mil-thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

	Maximum Span	Minimum Rod Size
NPS 3/4	7 feet	1/4 inch
NPS 1	7 feet	1/4 inch
NPS 1-1/2	9 feet	3/8 inch
NPS 2	10 feet	3/8 inch
NPS 2-1/2	11 feet	3/8 inch
NPS 3	12 feet	3/8 inch
NPS 4	12 feet	1/2 inch
NPS 6	12 feet	1/2 inch
NPS 8	12 feet	5/8 inch
NPS 10	12 feet	3/4 inch

	Maximum Span	Minimum Rod Size
NPS 12	12 feet	7/8 inch
NPS 14	12 feet	1 inch
NPS 16	12 feet	1 inch
NPS 18	12 feet	1-1/4 inch
NPS 20	12 feet	1-1/4 inch
NPS 24	12 feet	1-1/4 inch

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

	Maximum Span	Minimum Rod Size
NPS 3/4	5 feet	1/4 inch
NPS 1	6 feet	1/4 inch
NPS 1-1/4	6 feet	3/8 inch
NPS 1-1/2	8 feet	3/8 inch
NPS 2	8 feet	3/8 inch
NPS 2-1/2	9 feet	3/8 inch
NPS 3	10 feet	3/8 inch
NPS 4	10 feet	1/2 inch
NPS 6	10 feet	1/2 inch
NPS 8	10 feet	5/8 inch
NPS 10	10 feet	3/4 inch
NPS 12	10 feet	7/8 inch

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's Copper Tube Handbook, using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's Brazing Handbook, Pipe and Tube Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints. Inserted tubing must be cut and dimpled.

I. Hot Taps:

1. Hot taps shall only be made on systems that cannot be isolated or shut down and are not permitted in new construction.

2. The hot tap machine shall be provided with a depth gauge to prevent cutting of opposite pipe wall.

3. The hot tap machine shall be rated for the expected pressures and temperatures of the system being tapped.

4. Weld-o-lets, split tees, saddles, branch-o-lets, or nozzles shall be used on all hot taps. Full encirclement pads or split tees shall be used if the hot tap diameter is greater than 50% of the run pipe diameter.

5. Pipe coupons must be removed and not allowed to enter system. Return coupons to the Owner.

J. Dielectric Connections: Use the following to connect copper or brass piping materials to ferrous piping materials:

1. Piping NPS 4 Inches and Smaller: Dielectric nipples.

2. Piping NPS 5 Inches and Larger: Copper flange adapters.

3. Bronze body valves may be used in lieu of the dielectric connection specified above.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install flexible connectors at the inlet and outlet of all moving equipment, except pumps or as indicated otherwise. Match size of adjacent pipe.

C. Install flexible hoses at the inlet and outlet of all fan coil units, air terminal unit reheat coils, or water source heat pumps with connection sizes 1-1/2 inch NPS and smaller. Match size of equipment connection.

1. Maximum Hose Bend: Do not exceed 180 degrees.

2. Maximum Pipe Offset: Not to exceed 3 inches.

3. Comply with manufacturer's written limitations and instructions.

D. Install control valves in accessible locations close to connected equipment.

E. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Specification Section 23 05 19, Meters and Gages for HVAC Piping.

3.8 CLEANING AND CHEMICAL TREATMENT

A. Cleaning and passivation is required for all new piping whether installed as part of a new system or the extension of an existing system. This Contractor is responsible to provide pumps, valves, temporary piping, and all other items, except chemicals, required to properly clean the new piping prior to the piping being put into service or connected to an existing system.

B. Flush water fill lines separately to drain, to prevent rust and debris in the water main from entering the hydronic system(s).

C. During the cleaning process, maintain a minimum liquid velocity of 3 feet per second through piping systems. All manual, motorized, or thermostatically operated valves are to be open during this process. All equipment such as boilers, chillers, etc., shall be off. All dead end runs shall be looped together with piping not less than one-third the size of the run. Remove or isolate the end-run piping loop at the completion of the chemical treatment process. When connecting new piping to an existing system the new piping shall be looped together with piping not less than one-half the size of the new mains to allow for cleaning before linking the two systems. Remove or isolate the piping loop at the completion of the chemical treatment process.

D. Fill system with fresh water, clean and passivate interior of piping systems using chemicals supplied by the HVAC Water Treatment Contractor. Circulate chemicals for a minimum of 24 hours or longer as directed to remove oils, dirt, and other compounds detrimental to the proper operation of the system.

E. Flush piping system with clean water to remove cleaning chemicals and debris. Remove and clean strainer screens, flush mud and debris from drop legs and other low points.

F. Immediately after cleaning and flushing, refill system with fresh water and chemicals supplied by the HVAC Water Treatment Contractor to inhibit corrosion. Circulate for a minimum of 2 hours.

G. Do not repeatedly fill and drain system without proper chemical treatment.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's design pressure indicated on the drawings. If the design pressure is not indicated, use the minimum working pressure indicated above. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90% of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, Building Services Piping.

5. After hydrostatic test pressure has been applied for at least 30 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.

2. Inspect pumps for proper rotation.

3. Set makeup pressure-reducing valves for required system pressure.

4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).

5. Set temperature controls so all coils are calling for full flow.

6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

7. Verify lubrication of motors and bearings.

END OF SECTION

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SECTION 23 21 15

HVAC DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes pipe and fitting materials, and joining methods for HVAC drain piping including coil condensate drains.

1.2 PERFORMANCE REQUIREMENTS

A. Drain piping components and installation shall be capable of withstanding 5 psig at 150°F.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's product literature indicating materials of construction, ratings, options, and accessories for each type of the following:

1. Pipe and fittings.

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, Building Services Piping, for materials, products, and installation.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B88, Type L.

B. DWV Copper Tubing: ASTM B306, Type DWV.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

2.2 JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

B. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180°F.

D. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Drain Piping: Type DWV or Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated piping locations and arrangements if such were used to size pipe. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Avoid routing piping on floor across walkways. Provide steel ramps over piping where floor mounted piping crosses walkways.

D. Do not install drain piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe serving equipment serving the room. Maintain all required clearances to other equipment.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping at a uniform grade of 1.0% downward towards drain outlet unless otherwise indicated.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install cleanouts fabricated with a tee fitting with a threaded plug at each change of direction to facilitate cleaning of pipe. Cleanout shall allow for cleaning in direction of flow.

J. Install piping to allow application of insulation.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Reduce pipe sizes using concentric reducer fitting or eccentric reducer fitting installed with level side up.

M. Make branch connections to mains using flow tees.

N. Unless otherwise indicated, install branch connections to mains with the branch connected to the top or side of the main pipe.

O. Terminate piping with downturned elbows above an approved indirect receptor or other approved location as indicated on drawings.

P. Provide an air gap between the pipe termination and receptor or other approved location that is not less than 2 times the effective diameter or the pipe.

Q. Install unions in piping, NPS 2 and smaller at final connections of equipment, and elsewhere as indicated.

R. Identify piping as specified in Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Specification Section 23 05 17, Sleeves and Sleeve Seals for HVAC Piping.

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Specification Section 23 05 17, Sleeves and Sleeve Seals for HVAC Piping.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Specification Section 23 05 18, Escutcheons for HVAC Piping.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment. Comply with the following requirements for maximum spacing of supports.

B. Vibration isolation devices are specified in Specification Section 23 05 48.13, Vibration Controls for HVAC Piping and Equipment.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

2. Wrap copper piping with not less than two layers of 10-mil-thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

	Maximum Span	Minimum Rod Size
NPS 3/4	5 feet	1/4 inch
NPS 1	6 feet	1/4 inch

	Maximum Span	Minimum Rod Size
NPS 1-1/4	6 feet	3/8 inch
NPS 1-1/2	8 feet	3/8 inch
NPS 2	8 feet	3/8 inch
NPS 2-1/2	9 feet	3/8 inch
NPS 3	10 feet	3/8 inch
NPS 4	10 feet	1/2 inch

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's Copper Tube Handbook, using lead-free solder alloy complying with ASTM B32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Install vented traps at cooling coil condensate pan connections. Size trap and connected piping the same as or larger than equipment connections.

B. Size trap to provide seal against fan static pressure.

3.6 FIELD QUALITY CONTROL

A. Prepare drain piping according to ASME B31.9 and as follows:

1. Leave joints uninsulated and exposed for examination during test.

2. Flush drain piping systems with clean water.

3. Isolate equipment from piping.

B. Perform the following tests on drain piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. Subject piping system to hydrostatic test pressure that is equal to 10 feet of water column or maximum that can be obtained based on installed conditions.

3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

4. Prepare written report of testing.

END OF SECTION

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SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes refrigerant piping used for air-conditioning applications.

B. Refrigerant type shall be consistent with refrigeration equipment specified in other sections.

C. Refrigerant piping indicated on the drawings is schematic and intended to show the routing of the piping only.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-22:

1. Suction Lines for Air-Conditioning Applications: 185 psig.

2. Suction Lines for Heat-Pump Applications: 325 psig.

3. Hot-Gas and Liquid Lines: 325 psig.

B. Line Test Pressure for Refrigerant R-407c:

1. Suction Lines for Air-Conditioning Applications: 185 psig.

2. Suction Lines for Heat-Pump Applications: 325 psig.

3. Hot-Gas and Liquid Lines: 325 psig.

C. Line Test Pressure for Refrigerant R-410a:

1. Suction Lines for Air-Conditioning Applications: 300 psig.

2. Suction Lines for Heat-Pump Applications: 525 psig.

3. Hot-Gas and Liquid Lines: 525 psig.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer’s test data for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Pipe Sizing Guidelines: Equipment manufacturer’s guidelines for layout and sizing of refrigerant piping.

C. Shop Drawings: The Contractor is required to submit an isometric piping layout with each condensing unit submittal showing the detailed refrigerant piping layout. This refrigerant pipe layout is to include the following:

1. System identification.

2. All components, accessories, specialties, lengths, and elevation difference between compressor and evaporator.

3. Total equivalent length of the piping system.

4. Pipe sizing, oil traps, double risers, etc., required to ensure proper operation and compliance with warranties of the connected equipment.

5. Refrigerant pipe layout, sizing and components must conform to standard engineering practice as recognized by ARI, the ASHRAE Refrigeration Handbook and the equipment manufacturer's written recommendations.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, Safety Code for Refrigeration Systems.

B. Comply with ASME B31.5, Refrigeration Piping and Heat Transfer Components.

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B88, Type K or L or ASTM B280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

1. Elbows shall be long radius type.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals:

1. Copper-to-Copper Joints: BCuP-5 or BCuP-6 without flux.

2. Copper-to-Steel or Brass Joints: BAg-28 with non-acid flux.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

4. Pressure Rating: Factory test at minimum 500 psig.

5. Maximum Operating Temperature: 250°F.

2.2 VALVES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.

2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.

3. Operator: Rising stem and hand wheel.

4. Seat: Nylon.

5. End Connections: Socket, union, or flanged.

6. Working Pressure Rating: 500 psig.

7. Maximum Operating Temperature: 275°F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.

2. Packing: Molded stem, back-seating, and replaceable under pressure.

3. Operator: Rising stem.

4. Seat: Non-rotating, self-aligning polytetrafluoroethylene.

5. Seal Cap: Forged-brass or valox hex cap.

6. End Connections: Socket, union, threaded, or flanged.

7. Working Pressure Rating: 500 psig.

8. Maximum Operating Temperature: 275°F.

C. Packed Ball Valves:

1. Body: Two-piece, forged brass.

2. Extensions: Copper tubing.

3. Bonnet: Brass.

4. Stem Seals: Neoprene.

5. Ball: Chrome-plated brass.

6. Seals: Teflon.

7. Working Pressure Rating: 500 psig.

8. Maximum Operating Temperature: 300°F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Copper spring.

5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by a nationally recognized testing laboratory (NRTL).

1. Body and Bonnet: Plated steel.

2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 VAC coil.

6. Working Pressure Rating: 400 psig.

7. Maximum Operating Temperature: 240°F.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Moisture/Liquid Indicators:

1. Body: Forged brass.

2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

3. Indicator: Color-coded to show moisture content in ppm.

4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.

6. Working Pressure Rating: 500 psig.

7. Maximum Operating Temperature: 240°F.

B. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.

2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.

4. Designed for reverse flow (for heat-pump applications).

5. End Connections: Socket.

6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

7. Maximum Pressure Loss: 2 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 240°F.

C. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.

2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.

4. Designed for reverse flow (for heat-pump applications).

5. End Connections: Socket.

6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

7. Maximum Pressure Loss: 2 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 240°F.

2.4 ACCUMULATORS

A. Liquid Accumulators 6-Inch Diameter and Smaller: Comply with ARI 495; listed and labeled by an NRTL.

1. Body: Brazed steel with corrosion-resistant coating.

2. Connections: Socket or threaded for inlet, outlet and pressure relief valve.

3. Working Pressure Rating: 400 psig.

4. Maximum Operating Temperature: 275°F.

2.5 HANGERS AND SUPPORTS

A. Pipe and Tubing Isolation Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-Line Systems.

b. Elgen.

c. Grinnell.

d. Hydra-Zorb.

e. Kin-Line.

f. Michigan Hanger Co.

g. National Pipe Hanger Corp.

h. PHD Manufacturing.

i. PHS Industries.

j. Pipe Technology and Products.

k. Unistrut.

2. Material: Oil, fuel, solvent, resistant thermoplastic elastomer. UL Listed for installation in return air plenums with a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3. Design: Slit insert, designed for use with strut clamps to prevent metal-to-metal contact, reduce vibration transmission, and to securely hold pipe or tubing in position.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground Refrigerant Lines:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints or refrigerant line kits.

2. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Belowground Refrigerant Piping: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints. No joints below ground.

C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K, or L (B) drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Except as otherwise indicated, install diaphragm packless, packed-angle, or packed ball valves on inlet and outlet side of filter dryers.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install safety relief valves where required by the ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

D. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

E. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION

A. Drawing plans indicate general location and arrangement of piping systems. Install piping as indicated on the approved shop drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 specifications if valves or equipment requiring maintenance are concealed behind finished surfaces.

L. Install refrigerant piping in Schedule 40 PVC protective conduit where installed belowground. Size conduit to allow replacement of largest refrigerant pipe. Vent conduit to outdoors.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

O. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

S. Install sleeve seals for piping penetrations of concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS Brazing Handbook, Chapter 35, Pipe and Tubing.

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

B. Flow nitrogen or carbon dioxide through pipe and fittings during brazing to prevent scale formation.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Specification Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.

B. Install the following pipe attachments:

1. Provide trapeze hangers for multiple, parallel runs.

2. Secure pipe to strut supports with pipe clamps or single-piece pipe straps

3. Provide pipe and tube isolation device at each clamp and support.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

	Maximum Span	Minimum Rod Size
NPS 1/2	60 inches	1/4 inch
NPS 5/8	60 inches	1/4 inch
NPS 1	72 inches	1/4 inch
NPS 1-1/4	96 inches	3/8 inch
NPS 1-1/2	96 inches	3/8 inch
NPS 2	96 inches	3/8 inch
NPS 2-1/2	108 inches	3/8 inch
NPS 3	10 feet	3/8 inch
NPS 4	10 feet	1/2 inch

D. Support multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1, Performance Requirements article or as required by the Authorities Having Jurisdiction.

a. Fill system with nitrogen to the required test pressure.

b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust setpoint temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer’s written instructions:

1. Open shutoff valves in condenser water circuit.

2. Verify that compressor oil level is correct.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

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SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Rectangular rigid ducts and fittings.

2. Round rigid ducts and fittings.

3. Sheet metal materials.

4. Duct liner.

5. Sealants and gaskets.

6. Hangers and supports.

1.2 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Provide the following for each duct application and pressure classification: Metal gauge, construction methods, reinforcement details and spacing, hangers and support details, seam and joint types. Include manufacturer, description of material, locations for use, R-value, and thickness for duct liner.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, Structural Welding Code - Steel, for hangers and supports.

2. AWS D9.1M/D9.1, Sheet Metal Welding Code, for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 RECTANGULAR RIGID DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, based on indicated static-pressure class unless otherwise indicated.

B. Duct sizes shown on the drawings are clear, inside dimensions. Adjust sizes of sheet metal ductwork to account for duct lining.

C. Exterior Ductwork: Cross-break or slope the top of all ductwork mounted outside the building to promote drainage and prevent water from ponding on the top of the ductwork.

D. Transverse Joints: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 2-1, Transverse (Girth) Joints, or manufacturer's instructions for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition. Select joint types from the following:

1. Flat Drive Slip, T-1, T-3.

2. Standing Drive Slip, T-2.

3. Hemmed "S" Slip, T-6.

4. Companion, Angle-Van Stone Type, T-22, T-22 Alternate.

5. Flanged, formed, T-24, T-24 Alternate, or one of the following manufactured products:

   a. Ductmate or WDCI by Ductmate Industries, Inc.

   b. Elgen- or J-Flange by Elgen Manufacturing.

   c. FLG J or H by Ward Industries; a Division of Hart & Cooley, Inc.

   d. J Flange by CL Ward & Family, Inc.

   e. J Flange by Nexus PDQ; Division of Shilco Holdings Inc.

E. Longitudinal Seams: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 2-2, Longitudinal Seams - Rectangular Ducts, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition. Select seam type based on the following:

1. Duct with Static Pressure 2-Inch wg and Less: Pittsburg lock hammered flat, L-1, or button punch snap lock, L-2. Do not use button punch snap lock on aluminum duct.

2. Duct with Static Pressure Greater than 2-Inch wg: Pittsburg lock hammered flat, L-1.

F. Elbows: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 4-2, Rectangular Elbows. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition. Select elbows from the following types:

1. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3. Mitered Type RE 2 with single thickness turning vanes complying with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 4-3, Vanes and Vane Runners, and Figure 4-4, Vane Support in Elbows.

G. Branches: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 4-5, Divided Flow Branches and Figure 4-6, Branch Connections. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition. Select branch connections from the following types:

1. Rectangular Main to Rectangular Branch: 45-degree entry.

2. Rectangular Main to Round Branch: Conical or 45-degree lead in.

H. Transitions, Offsets, and Other Duct Construction: Select types and fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Chapter 4, Fittings and Other Construction, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

2.2 ROUND RIGID DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Chapter 3, Round, Oval, and Flexible Duct, based on indicated static-pressure class unless otherwise indicated.

B. Duct sizes shown on the drawings are clear, inside dimensions. Adjust sizes of sheet metal ductwork to account for duct lining.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 3-1, Transverse Joints - Round Duct, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

1. Transverse Joints in Ducts Larger than 60 Inches in Diameter: Flanged or the following manufactured products:

a. SpiralFlange by CL Ward & Family, Inc.

D. Spiral Seams: Provide spiral seam ductwork using seam RL-1 and fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 3-2, Round Duct Longitudinal Seams, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

E. Elbows: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 3-4, Round Duct Elbows. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition.

1. Minimum Radius-to-Diameter Ratio shall be 1.5.

2. Elbow Segments: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Table 3-1, Mitered Elbows. Elbows with less than 90-degree change of direction have proportionately fewer segments.

3. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

4. Round Elbows, 14 Inches and Larger in Diameter: Welded.

F. Tees and Laterals: Fabricate according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 3-5, 90 Degree Tees and Laterals, and Figure 3-6, Conical Tees. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions in SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition. Select tees and laterals based on the following:

1. Velocity up to 1,500 fpm: Conical tap.

2. Velocity 1,500 fpm or Higher: 45-degree lateral.

3. Conical saddle taps may be used in existing duct.

2.3 PRODUCT CONVEYING DUCTWORK

A. General Fabrication Requirements: Comply with SMACNA's Round Industrial Duct Construction Standards based on indicated static-pressure class unless otherwise indicated.

B. Duct sizes shown on the drawings are clear, inside dimensions.

C. Transverse Joints: Joints shall be air- and liquid-tight. Joints may be welded, soldered, flanged with gaskets, or clamped with gaskets.

D. Longitudinal Seams: Seams shall be air- and liquid-tight. Seams may be welded, soldered or sealed with sealant compatible with the chemicals used in the system. Sealant shall be integral to the seam. Field-applied sealant is not allowed.

E. Elbows: Fabricate according to SMACNA's Round Industrial Duct Construction Standards. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions.

1. Minimum Radius-to-Diameter Ratio shall be 1.5.

2. Elbow Segments: Comply with SMACNA's Round Industrial Duct Construction Standards. Elbows with less than 90-degree change of direction have proportionately fewer segments.

3. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or welded.

4. Round Elbows, 14 Inches and Larger in Diameter: Welded.

F. Tees and Laterals: Fabricate according to SMACNA's Round Industrial Duct Construction Standards. Comply with requirements for indicated static-pressure class, sealing requirements, support intervals, and other provisions in SMACNA's Round Industrial Duct Construction Standards. Select tees and laterals based on the following:

1. Velocity up to 1,500 fpm: Conical tap.

2. Velocity 1,500 fpm or Higher: 45-degree lateral.

3. Conical saddle taps may be used in existing duct.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in the Duct Schedule article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the Duct Schedule article.

D. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

E. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, stainless steel, or aluminum to match duct material, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, Fibrous Glass Duct Liner Standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.

b. Johns Manville.

c. Knauf Insulation.

d. Owens Corning.

2. Maximum Thermal Conductivity: Type I, Flexible: 0.27 Btu x in./h x sq.ft. x degrees F at 75°F mean temperature.

3. Anti-Microbial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture-repellent and erosion-resistant coating. Anti-microbial compound shall be tested for efficacy by a nationally recognized testing laboratory (NRTL) and registered by the EPA for use in HVAC systems.

B. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mechanical Fasteners:

1. Metal, Capacitor-Discharge-Weld Pin, Insulation Hangers: Copper-coated, low carbon steel, or stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated. May be provided with base.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

3. Metal, Cupped-Head, Capacitor-Discharge-Weld Pins:

a. Head: Galvanized, carbon-steel or stainless-steel sheet, minimum of 0.016 inch thick with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

b. Spindle: Copper- or zinc-coated, low carbon steel, or stainless-steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

D. Shop Application of Fibrous-Glass Duct Liner in Rectangular Ducts: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Figure 7-11, Flexible Duct Liner Installation.

1. Duct sizes shown on the drawings are clear, inside dimensions. Adjust sizes of sheet metal ductwork to account for duct lining.

2. Adhere a single layer of indicated thickness of duct liner with at least 90% adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

3. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

4. Butt transverse joints without gaps, and coat joint with adhesive.

5. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

6. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

7. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2,500 fpm.

8. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

9. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.

   b. Intervals of lined duct preceding unlined duct.

   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2,500 fpm or where indicated.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

E. Shop Application of Fibrous-Glass Duct Liner in Round Ducts:

1. Duct sizes shown on the drawings are clear, inside dimensions. Adjust sizes of sheet metal ductwork to account for duct lining.

2. Follow liner manufacturer's written instructions.

   a. Apply adhesive or other fastening devices in fittings or small duct sections as recommended.

   b. Apply edge coating at all exposed edges without a factory coating.

   c. Properly repair any tears, rips, or damaged areas as recommended.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Polymer Joint and Seam Sealant:

1. Application Method: Pump applied during duct forming or assembly.

2. Solids Content: Minimum 90%.

3. Water resistant.

4. Mold and mildew resistant.

5. Non-skinning, non-drying.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor or outdoor.

8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65%.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq.ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Non-Corrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Table 5-1, Rectangular Duct Hangers Minimum Size, and Table 5-2, Minimum Hanger Sizes for Round Duct.

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION – GENERAL REQUIREMENTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved.

B. Install ducts according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of the same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Specification Section 23 33 00, Air Duct Accessories, for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris, dust, and other foreign materials. Comply with the “Advanced Level” of cleanliness as defined in SMACNA’s Duct Cleanliness for New Construction Guidelines.

1. This includes protecting the ductwork from dirt, debris and moisture, during transportation to the jobsite, prior to installation at the jobsite, and after installation.

3.2 EXPOSED DUCTWORK INSTALLATION – ADDITIONAL REQUIREMENTS

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Fabricate exposed ductwork with internal seam sealant.

C. Construct joints with internal sealing elements.

D. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

E. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

F. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

G. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible:

1. All Ductwork: Seal Class A.

2. All joints, wall penetrations, and seams to be externally sealed even if internal sealant is applied during duct forming and fabrication, except for exposed ductwork.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Chapter 5, Hangers and Supports.

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured and as directed by the Structural Engineer.

C. Hanger Spacing: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, Table 5-1, Rectangular Duct Hangers Minimum Size, and Table 5-2, Minimum Hanger Sizes for Round Duct, for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod, and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Specification Section 23 33 00, Air Duct Accessories.

B. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition and requirements herein for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint the inside of any ductwork including manual volume dampers that is visible through a grille, register, or diffuser with one coat of flat, black paint. Visible duct liner must have a black finish.

3.7 STARTUP

A. Air Balance: Comply with requirements in Specification Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

3.8 DUCT SCHEDULE

A. Fabricate rigid ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Air-Conditioners, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Air-Conditioners, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

D. Exhaust Ducts:

1. Ducts Connected to Domestic Clothes Dryers:

a. Pressure Class: Positive 2-inch wg.

b. Minimum Duct Gauge: 26.

c. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

e. Elbows: Stamped or segmented only.

2. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: Refer to Duct Sealing article.

c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum.

G. Duct Liner: Furnish ducts with duct liner for the following applications unless noted otherwise on the drawings:

1. Rectangular Supply and Return Air Ducts Within a Return Air Plenum or Within the Room It Serves: Fibrous glass, Type I, 1/2 inch thick with a minimum R-value of 2.

2. Rectangular Supply and Return Air Ducts Within the Building Envelope: Fibrous glass, Type I, 1-1/2 inches thick with a minimum R-value of 6.

3. Rectangular Supply and Return Air Ducts Outside the Building Envelope: Fibrous glass, Type I, 2 inches thick with a minimum R-value of 8.

4. Rectangular Exhaust Air Ducts Within the Building Envelope: Fibrous glass, Type I, 1/2 inch thick.

5. Supply and Return Fan Plenums Within the Building Envelope: Fibrous glass, Type II, 1-1/2 inches thick with a minimum R-value of 6.

6. Supply and Return Fan Plenums Outside the Building Envelope: Fibrous glass, Type II, 2 inches thick with a minimum R-value of 8.

7. Transfer Ducts: Fibrous glass, Type I, 1/2 inch thick.

8. Exception: Do not line ductwork connected to evaporative coolers, ductwork connected to kitchen hoods, outside air intakes, ductwork serving shower areas, or combustion air ducts.

END OF SECTION

Edition 0307-0522

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Backdraft and pressure-relief dampers.

2. Manual volume dampers.

3. Control dampers.

4. Fire dampers.

5. Smoke dampers.

6. Combination fire/smoke dampers.

7. Flange connectors.

8. Turning vanes.

9. Duct-mounted access doors.

10. Flexible connectors.

11. Flexible ducts.

12. Domestic clothes dryer connection box and vent termination.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer’s product data for each duct accessory intended for use on this project. Data to be specific to the items proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Dimensions.

3. Electrical data for damper motor operators including voltage and motor ampacity.

4. Materials of construction.

5. Accessories and options.

6. Installation details for fire, smoke, and combination fire/smoke dampers for each application intended for this project.

B. Test reports for smoke and combination fire/smoke dampers.

C. Warranty information.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, Installation of Air Conditioning and Ventilating Systems, and with NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.

2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.

2. Elgen Manufacturing.

3. Greenheck Fan Corporation.

4. McGill Airflow LLC.

5. Metal Form.

6. Nailor Industries Inc.

7. National Controlled Air.

8. Pottorff.

9. Ruskin Company.

10. Safe-Air-Dowco.

11. Vent Products Company, Inc.

12. Young Regulator Company.

B. Backdraft and Pressure-Relief Dampers:

1. Description: Counterbalanced.

2. Maximum Air Velocity: 2,000 fpm.

3. Static Pressure Range: 0.01 to 0.10 inch wg.

4. Frame: Hat-shaped, minimum 0.052-inch-thick, galvanized sheet steel, 0.063-inch-thick extruded aluminum or 0.052-inch-thick stainless steel, with welded corners and mounting flange.

5. Blades: Multiple single-piece blades, maximum 6-inch-width, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet with sealed edges. Blade material shall match frame material.

6. Blade Action: Parallel.

7. Blade Seals: Extruded vinyl or neoprene mechanically locked.

8. Blade Axles:

   a. Material: Galvanized steel, stainless steel or aluminum to match frame and blades.

   b. Diameter: Minimum 0.20 inch.

9. Tie Bars and Brackets: Aluminum or galvanized steel to match axles.

10. Bearings: Steel ball or synthetic pivot bushings.

11. Counterweights: Adjustable for varying differential static pressure as well as horizontal and vertical airflow.

C. Manual Volume Dampers:

1. Rectangular:

a. Factory fabricated for shutoff or balancing duty in branch ducts:

1) Standard leakage rating, with linkage outside airstream.

2) Suitable for horizontal or vertical applications.

3) Frames:

a) Hat-shaped, galvanized-steel or aluminum channels.

b) Mitered and welded corners.

c) Flanges for attaching to walls and flangeless frames for installing in ducts.

4) Blades:

a) Multiple with maximum blade width of 8 inches.

b) Opposed-blade design.

c) Stiffen damper blades for stability.

d) Galvanized steel, 0.064 inch thick, or aluminum 0.10 inch thick to match frame.

5) Blade Axles: Galvanized steel or aluminum to match frame and blades.

6) Bearings:

a) Oil-impregnated bronze or molded synthetic.

b) Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7) Tie Bars and Brackets: Galvanized steel or aluminum to match frame and blades.

8) Jackshaft:

a) Size: 1-inch diameter.

b) Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

c) Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

9) Damper Hardware:

a) Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

b) Include center hole to suit damper operating-rod size.

c) Include elevated platform for insulated duct mounting.

b. Shop and field fabricated for balancing duty in duct runouts serving a single diffuser, grille, or register:

1) Blade: Single blade volume damper constructed per SMACNA Standards.

2) Handle: Stamped or cast metal configured to indicate damper position in duct. Provide extension to raise handle above duct insulation and locking device such as wing nut to secure extension device to side of damper bearing and duct, or standoff with locking quadrant to secure damper in position, similar to Ventlok 641 in uninsulated ducts, Ventlok 644 in insulated ducts, or Ventlok 555 with standoff in either.

2. Round:

a. Factory fabricated for shutoff or balancing duty in branch ducts:

1) Standard leakage rating.

2) Suitable for horizontal or vertical applications.

3) Frames: Galvanized-steel channel.

4) Blades: Galvanized steel, minimum 16 gauge.

5) Blade Axles: Plated steel extending minimum 6 inches beyond frame.

6) Bearings: Nylon sleeve with stainless-steel thrust washers.

7) Stops: Plated screw for both open and closed positions.

8) Damper Hardware:

a) Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

b) Include center hole to suit damper operating-rod size.

c) Include elevated platform for insulated duct mounting.

d) Include locking quadrant to secure damper in position similar to Ventlok 555 or self-locking handle similar to Ventlok 641 in uninsulated ducts or Ventlok 644 in insulated ducts.

b. Shop and field fabricated for balancing duty in duct runouts serving a single diffuser, grille or register:

1) Blade: Single blade volume damper constructed per SMACNA Standards.

2) Stamped or cast metal configured to indicate damper position in duct. Provide extension to raise handle above duct insulation and locking device such as wing nut to secure extension device to side of damper bearing and duct, or standoff with locking quadrant to secure damper in position, similar to Ventlok 641 in uninsulated ducts, Ventlok 644 in insulated ducts, or Ventlok 555 with standoff in either.

3. Remote Damper Operators:

a. Damper operator for remote operation of manual balancing dampers located above hard ceilings or other inaccessible locations.

b. Electrically Activated: Greenheck RBD-10.

1) Electrically actuated motor for field mounting on manual balancing damper shaft.

2) Plenum-rated, interconnect cable in length suitable to reach remote wall, ceiling, or diffuser plate.

3) Handheld, battery-powered controller for actuation of motor.

c. Manually Activated: Young 270-315.

1) Galvanized steel rack and pinion controller for attachment to the balancing damper shaft.

2) Bowden cable with galvanized steel outer casing and stainless-steel inner wire in length as required but no more than 50 feet.

3) Ceiling mounted, die-cast mounting cup, with adjustable threaded cover.

d. Provide all accessories required for the intended application.

D. Control Dampers:

1. AMCA-rated.

2. Rectangular:

a. Frames:

1) Hat or U-channel.

2) Galvanized steel, minimum 0.064 inch thick.

3) Mitered and welded corners.

b. Blades:

1) Airfoil shape.

2) Multiple blade with maximum blade width of 8 inches and length of 48 inches.

3) Opposed-blade design for throttling or on-off duty, parallel-blade design for on-off duty.

4) Galvanized steel.

5) 0.080 inch thick.

6) Blade Edge Seals: Inflatable blade edging or replaceable rubber blade seals.

7) Blade Jamb Seals: Flexible metal compression seal.

c. Blade Axles: 1/2-inch diameter; plated or galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings and thrust bearings at each end of every blade.

1) Operating Temperature Range: From -40 to +200°F.

d. Bearings:

1) Oil-impregnated bronze, stainless steel, or molded synthetic.

2) Dampers in ducts with pressure classes of 3-inch w.g. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3) Thrust bearings at each end of every blade.

e. Leakage: Maximum of 3 cfm/sq.ft. at 1-inch wg.

3. Round:

a. Frames: Galvanized steel, minimum 0.040 inch thick.

b. Blade: Two layers of galvanized steel, each a minimum 0.080 inch thick.

c. Blade Seal: Neoprene sandwiched between blade layers extending beyond blades all around.

d. Blade Axle: 1/2-inch diameter extended full length of blade; plated or galvanized steel extending beyond frame as required for operator mounting.

1) Maximum Operating Temperature: 200°F.

e. Bearings: Oil-impregnated bronze, stainless steel, or molded synthetic.

f. Leakage: Maximum of 0.15 cfm per inch of blade circumference at 1-inch w.g

2.3 FIRE DAMPERS, SMOKE DAMPERS, COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff; a Division of PCI Industries, Inc.

3. Ruskin Company.

B. Fire Dampers:

1. Type: Dynamic; rated and labeled according to UL 555 by a nationally recognized testing laboratory (NRTL).

2. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4,000-fpm velocity.

3. Fire Rating: 1-1/2 hours or longer as required or noted on the drawings.

4. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

5. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

a. Minimum Thickness: 0.052 to 0.138 inch thick and of length to suit application.

b. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

6. Mounting Orientation: Vertical or horizontal as indicated.

7. Blades: Roll-formed, interlocking, 0.034-inch-thick galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick galvanized-steel blade connectors.

8. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

9. Heat-Responsive Device: Replaceable, 165°F rated, fusible links.

C. Smoke Dampers:

1. General Requirements: Label according to UL 555S by an NRTL.

2. Smoke Detector: Integral, factory wired for single-point connection where indicated.

3. Frame: Multiple-blade type fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

4. Blades: Roll-formed, horizontal, interlocking, 0.034-inch-thick galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick galvanized-steel blade connectors.

5. Leakage: Class I.

6. Rated pressure and velocity to exceed design airflow conditions.

7. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

8. Damper Motors: Two-position action, externally mounted.

9. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

   a. Motor Sizes: Provide motor large enough so driven load will not require motor to operate in service factor range above 1.0.

   b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 sections.

   c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

   d. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf. and breakaway torque rating of 150 in. x lbf.

   e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at -40°F.

   f. Electrical Connection: 115 V, single phase, 60 Hz.

10. Accessories:

    a. Auxiliary switches for signaling or position indication where dampers are installed in smoke control systems or elsewhere as indicated.

    b. Momentary test switch, and test and reset switches, damper or remote mounted as indicated.

D. Combination Fire and Smoke Dampers:

1. General Requirements: Label according to UL 555 and UL 555S by an NRTL.

2. Closing rating in ducts up to 4-inch wg static pressure and maximum airflow through the open damper of 2,000 fpm.

3. Smoke Detector: Integral, factory wired for single-point connection where indicated.

4. Fire Rating: 1-1/2 hours or longer as required or noted on the drawings.

5. Leakage: Class 1.

6. Rectangular Damper Construction:

   a. Frame: Hat-shaped, minimum 0.094-inch-thick galvanized sheet steel, with welded or interlocking, gusseted corners and mounting flange.

   b. Blades: Horizontal, airfoil shaped, minimum 0.063-inch-thick galvanized sheet steel.

   c. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

7. Round Damper Construction:

   a. Frame/Sleeve: Round, minimum 0.040-inch-thick galvanized sheet steel.

   b. Blades: Two-piece, 0.080-inch-thick galvanized sheet steel with silicone edge seal.

8. Heat Response Device: Electric fuse link 165°F rated.

9. Damper Motors: Two-position action, externally mounted unless indicated otherwise.

10. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

    a. Motor Sizes: Provide motor large enough so driven load will not require motor to operate in service factor range above 1.0.

    b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 sections.

    c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

    d. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf. and breakaway torque rating of 150 in. x lbf.

e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at -40°F.

f. Electrical Connection: 115 V, single phase, 60 Hz.

11. Accessories:

a. Auxiliary switches for signaling or position indication where dampers are installed in smoke control systems or elsewhere as indicated.

b. Momentary test switch, and test and reset switches, damper or remote mounted as indicated.

2.4 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition; Figures 4-3, Vanes and Vane Runners, and 4-4, Vane Support in Elbows.

C. Vane Construction: Single thickness with 3/4-inch trailing edge spaced at 1-1/2-inch centers.

2.5 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. American Warming and Ventilating.

2. CL Ward & Family, Inc.

3. Ductmate Industries, Inc.

4. Flexmaster U.S.A., Inc.

5. Greenheck.

6. McGill AirFlow Corporation.

7. Nailor Industries Inc.

8. Ventfabrics, Inc.

9. Ward Industries, Inc.; a Division of Hart & Cooley, Inc.

B. Rectangular Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition; Figure 7-2, Duct Access Doors and Panels.

1. Door:

a. Double wall, rectangular.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Where used in product conveying ducts, match duct material.

c. Hinges and Latches: 1" x 1" butt- or piano-hinge and cam latches.

d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets. Where used in product conveying ducts, match duct material.

3. Number of Hinges and Locks:

a. Access Doors Less than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c. Access Doors up to 24 Inches by 48 Inches: Three hinges and two compression latches.

d. Access Doors Larger than 24 Inches by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Round Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition; Figure 7-3, Access Panels - Round Duct.

1. Door:

a. Double wall, rectangular or oval.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Where used in product conveying ducts, match duct material.

c. Hinges and Latches: 1" x 1" butt- or piano-hinge and cam latches.

d. Fabricate doors airtight and suitable for duct pressure class.

2. Number of Hinges and Locks:

a. Access Doors Less than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c. Access Doors up to 24 Inches by 48 Inches: Three hinges and two compression latches.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. CL Ward & Family, Inc.

2. Ductmate Industries, Inc.

3. Duro Dyne Inc.

4. Elgen.

5. Ventfabrics, Inc.

6. Ward Industries, Inc.; a Division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or non-combustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric, double coated with neoprene.

1. Minimum Weight: 26 oz./sq.yd.

2. Tensile Strength: 480 lbf./inch in the warp and 360 lbf./inch in the filling.

3. Service Temperature: -40 to +200°F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric, double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq.yd.

2. Minimum Tensile Strength: 500 lbf./inch in the warp and 440 lbf./inch in the filling.

3. Service Temperature: -50 to +250°F.

2.7 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atco Flex.

2. Elgen.

3. Flexmaster U.S.A., Inc.

4. Genflex.

5. Manville.

6. Owens-Corning.

7. Therma Flex.

8. Wiremold.

B. Insulated, Flexible Duct: UL 181, Class 1, polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating:

a. Low Pressure: 4-inch wg positive and 0.5-inch wg negative.

b. High Pressure: 10-inch wg positive and 1.0-inch wg negative in applications over 2-inch wg.

2. Maximum Air Velocity: 4,000 fpm.

3. Temperature Range: -20 to +175°F.

4. Insulation R-Value: Comply with the latest edition of ASHRAE/ IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.8 DOMESTIC CLOTHES DRYER CONNECTION BOX AND VENT TERMINATION

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. In-O-Vate Technologies.

B. Dryer Connection Box: 22 gauge aluminized steel recessed box with 4-inch cutout for dryer vent.

1. Size: Minimum 9 inches wide, 18 inches tall, 4 inches deep inside recess for final dryer connection.

C. Vent Termination:

1. Wall Termination: Powder-coated galvanized-steel wall vent with frame, damper, and inlet collar. Damper secured with dual magnets for rodent protection. Select color to match adjacent surfaces.

2. Flat Roof: Galvanized-steel gooseneck cap designed for curb mounting complete with flapper door and 4-inch-diameter duct connection. Model 486U or approved equal.

3. Sloped Roof: Galvanized-steel gooseneck cap for roof mounting complete with flapper door, nailing flange, and 4-inch-diameter duct connection.

a. Model 466 for exposed residential applications with single roofing.

b. Model 486 for concealed residential applications or exposed residential applications with tile roofing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Select duct accessories suitable for the pressure class of the ductwork to which it is attached.

B. Install duct accessories according to applicable details in SMACNA's HVAC Duct Construction Standards - Metal and Flexible for metal ducts.

C. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

D. Install turning vanes in all rectangular duct elbows having a 45-degree or greater bend as indicated.

E. Install volume dampers at points on supply, return, and exhaust systems where branches serving diffusers and grilles extend from larger ducts. Install dampers where accessible and as close to mains as possible. Where dampers are installed in ducts having duct liner, install dampers with hat channels of the same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

F. Install volume dampers in outside-air systems at the connection to the equipment served.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

G. Install volume dampers where directed by the Test and Balance Contractor as required for proper system balancing.

H. Remote Damper Operators:

1. Install remote damper operators for all dampers located above hard ceilings or for dampers that will otherwise be inaccessible at the completion of construction.

2. Install remote damper operator in accordance with the manufacturer's written instructions.

3. Locate operator interface as indicated on the drawings or as instructed by the Architect/Engineer.

4. Finish cover to match adjacent ceiling.

I. Set dampers to fully open position before testing, adjusting, and balancing.

J. Install fire and smoke dampers according to UL listing at all duct penetrations of rated assemblies as required to maintain the rating as designated on the drawings.

K. Mount duct smoke detectors in strict conformance with manufacturer's recommendations. Duct smoke detectors to be furnished and wired as specified in Division 21, 26 or 28.

L. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment. Locate on side of duct with greatest clearance. Install at the following locations:

1. On both sides of duct coils. (Minimum head and hand access.)

2. Upstream and downstream from duct filters. (Minimum head and hand access.)

3. At outdoor-air intakes and mixed-air plenums. (Minimum head and hand access.)

4. At drain pans and seals. (Minimum head and hand access.)

5. Downstream from control dampers, backdraft dampers, and other duct-mounted equipment. (Minimum head and hand access.)

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure-relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers. (Minimum two-hand access.)

7. Elsewhere as indicated.

M. Install access doors with swing against duct static pressure.

N. Minimum Access Door Sizes:

1. One-Hand or Inspection Access: 8" x 5".

2. Two-Hand Access: 12" x 6".

3. Head and Hand Access: 18" x 10".

4. Head and Shoulders Access: 21" x 14".

5. Body Access: 25" x 14".

6. Body plus Ladder Access: 25" x 17".

O. Label access doors according to Specification Section 23 05 53, Identification for HVAC Piping and Equipment, to indicate the purpose of access door.

P. Install flexible connectors to connect ducts to equipment. Provide minimum 26 gauge sheet metal sunshields on flexible connectors exposed to weather.

Q. Install flexible connectors in duct crossing building expansion joints. Provide sheet metal sunshields on flexible connectors exposed to weather.

R. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

S. Flexible duct may only be used in the following locations with the following limitations:

1. Connect fan-powered terminal units to supply ducts with maximum 12 inch length of high-pressure flexible duct. Do not use flexible ducts to change directions.

2. Connect diffusers, grilles, or registers located in lay-in ceilings to ducts with maximum 60-inch lengths of low-pressure flexible duct secured in place with stainless-steel clamps.

3. Install flexible ducts stretched and supported without kinks or sags.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

END OF SECTION

Edition 0307-0121

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SECTION 23 37 13

DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate drawing designation, manufacturer, model number, materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, noise ratings, and accessories furnished.

PART 2 - PRODUCTS

2.1 DIFFUSERS, REGISTERS & GRILLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:

1. Anemostat.

2. Krueger.

3. Nailor Industries, Inc.

4. Price Industries.

5. Titus.

6. Tuttle & Bailey.

B. Materials:

1. Provide diffusers, registers, and grilles constructed of the materials indicated on the drawings.

2. Diffusers, registers, and grilles mounted in damp or wet locations such as shower rooms, kitchen areas, or installed in evaporative cooler systems shall be all aluminum construction.

3. Diffusers, registers, and grilles are to be factory finished unless noted otherwise. Provide color as scheduled or as directed by the Architect.

C. Source Quality Control:

1. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify the Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, and fire dampers.

D. Paint all interior ductwork visible through the diffuser, register, or grille flat black.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

Edition 0306-721

SECTION 23 37 23

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Roof hoods.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each product indicated on the drawings. Data to be specific to the product proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions and project elevation.

3. Dimensions.

4. Required clearances.

5. Materials of construction.

6. Accessories and options.

1.3 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:

1. Carnes.

2. Greenheck Fan Corporation.

3. Loren Cook Company.

4. PennBarry.

5. Western Vents & Curbs.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by the metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.

D. Fasteners: The same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.3 FABRICATION, GENERAL

A. Factory fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

2.4 ROOF HOODS

A. Factory fabricated according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figures 5-6 and 5-7.

B. Materials: Galvanized-steel sheet, minimum 0.064-inch-thick base and 0.040-inch-thick hood; or aluminum sheet, minimum 0.063-inch-thick base and 0.050-inch-thick hood; suitably reinforced.

C. Roof Curbs: Galvanized-steel sheet with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.

2. Overall Height: 14 inches unless noted otherwise.

D. Bird Screening: Galvanized-steel, 1/2-inch-square mesh, 0.041-inch wire; or aluminum, 1/2-inch-square mesh, 0.063-inch wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Division 07 specifications.

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 specifications for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Specification Section 23 05 53, Identification for HVAC Piping and Equipment.

G. Protect galvanized and non-ferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

END OF SECTION

Edition 0607-1215

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SECTION 23 72 00

AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes heat recovery equipment complete with fans, coils, filters, and air-to-air energy recovery heat exchangers.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions and project elevation.

3. Fans:

a. Certified fan-performance curves with system operating conditions indicated.

b. Certified fan-sound power ratings.

c. Fan construction and accessories.

d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.

5. Certified heat exchanger performance ratings at scheduled operating conditions.

6. Filters with performance characteristics.

7. Equipment dimensions and weights.

8. Required clearances.

9. Electrical Data:

a. Motor horsepower.

b. Voltage/Phase/Hz.

c. Full load ampacity, minimum circuit ampacity and maximum overcurrent protection device requirements.

d. Electrical service point(s) of connection.

e. AIC rating of the equipment.

10. Materials of construction, metal thickness, finishes, insulation, etc.

11. Accessories and options.

12. Controls.

13. Dampers, including housings, linkages, and operators.

14. Sound power ratings for the unit.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

2. Capacity ratings for air coils shall comply with ARI 410, Forced-Circulation Air-Cooling and Air-Heating Coils.

C. ASHRAE Compliance:

1. Applicable requirements in the latest edition of ASHRAE 62.1, Section 5 - Systems and Equipment, and Section 7 - Construction and Startup.

2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, Method of Testing Air-to-Air Heat Exchangers.

3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in the latest edition of ASHRAE/IESNA 90.1, Section 6 - Heating, Ventilating, and Air-Conditioning.

D. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, Ducted Heat Recovery Ventilators; or UL 1815, Nonducted Heat Recovery Ventilators.

2. Electric coils shall comply with requirements in UL 1995, Heating and Cooling Equipment.

1.4 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:

1. Advanced Thermal Technologies.
2. Airxchange Inc.
3. American Energy Exchange, Inc.
4. Carrier Corporation.
5. Daikin.
6. Des Champs Technologies.
7. Energy Labs.
8. Governair.
9. Greenheck.
10. Haakon.
11. Huntair.
12. Loren Cook Company.
13. Mitsubishi Electric Sales Canada Inc.
14. Nutech Brands Inc.
15. Pace.
16. RenewAire LLC.
17. SEMCO Incorporated.
18. Temtrol.
19. Trane; American Standard Companies, Inc.
20. Xetex Incorporated.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Outside Casing: Galvanized steel, minimum 16 gauge thick.

2. Inside Casing: Galvanized steel, solid, minimum 20 gauge thick.

3. Floor Plate: Galvanized steel, minimum 14 gauge thick with integral safety tread.

4. Insulation Thickness: Minimum of 2 inches.

5. Casing Leakage Rating: Less than 1% of rated unit airflow at 6 inches of wg.

6. Factory Finish for Steel and Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating. External surfaces shall have an enamel finish able to withstand a salt spray test in accordance with ASTM B117 for 500 hours.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in the latest edition of ASHRAE 62.1.

8. Casing panels shall be double wall, thermally broken, with minimum R-12 foam-type insulation between inner and outer panels.

9. Casing panels shall be sealed to unit frame with a neoprene full-perimeter gasket.

10. Roof: Slope a minimum of 0.125 inches per foot. Provide rain deflectors at all doors to direct water away from opening.

B. Inspection and Access Doors:

1. Door Fabrication: Construction and thickness shall be similar to casing panels. Provide double-paned vision window in all doors. Minimum 8 inch by 8 inch in size.

2. Frames: Frames shall channel water away from gasket and shall have protective flange to protect gasket from exposure.

a. Hinges: A minimum of two hinges or stainless-steel piano hinge and two latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential. Hinges and latches shall be adjustable.

b. Gasket: Neoprene, applied around entire perimeters of frames.

c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Locations: Provide access doors in the following sections:

a. Fan Section.

b. Access Section.

c. Coil Section.

d. Heat Exchanger Section.

e. Damper Section.

f. Filter Section.

C. Pipe Cabinet: Provide factory-assembled piping cabinet of the same construction as the main unit casing mounted external to the unit.

D. Condensate Drain Pans:

1. Fabricated with slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.

a. Length: Extend drain pan downstream from leaving face to comply with the latest edition of ASHRAE 62.1.

2. Materials: Stainless steel sheet.

3. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple.

4. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 SUPPLY FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

b. Designed to operate at no more than 70% of first critical speed at top of fan's speed range.

B. Single and Multiple Fan Units:

1. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.

2. Centrifugal Fan Wheels: Plenum, multi-blade double-width-double-inlet construction with curved inlet flange, back plate, welded or riveted to flange and back plate; cast-iron or cast-steel hub mechanically fastened to back plate and fastened to shaft with set screws.

3. Fan Shaft Bearings: Grease-lubricated, self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit and a rated L-50 life of 200,000 hours.

4. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

   a. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

   b. Motor Pulleys: Adjustable pitch for use with 5-HP motors and smaller; fixed pitch for use with motors larger than 5 HP. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.

   c. Belts: Oil resistant, non-sparking, and non-static; in matched sets for multiple-belt drives.

   d. Belt Guards (for motors mounted outside the casing): Comply with requirements specified by OSHA and fabricate according to SMACNA's HVAC Duct Construction Standards; 0.1046-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

5. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 2 inches.

C. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

1. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

3. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23.

4. Mount unit-mounted IEC starter-disconnect on exterior of unit. Units shall be factory wired, include a circuit breaker, control transformer, hand-off-auto switch with NEMA Type 1 enclosure.

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.

2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).

3. Coils shall not act as structural component of unit.

B. Water Coils:

1. Tube Material: Copper or as indicated on the drawings.

2. Tube Thickness: 0.020 inches minimum or as indicated on the drawings.

3. Fin Type: Plate or spiral.

4. Fin Material: Aluminum or as indicated on the drawings.

5. Fin Spacing: 12 fins per inch maximum or as indicated on the drawings.

6. Fin and Tube Joint: Mechanical bond.

7. Headers:

a. Cast iron or copper with cleaning plugs and drain and air vent tappings.

b. Seamless copper tube with brazed joints, prime coated.

c. Fabricated steel, with brazed joints, prime coated.

d. Provide insulated cover to conceal headers exposed outside casings.

8. Frames: Channel frame, 18 gauge thick galvanized steel minimum.

9. Coil Working-Pressure Ratings: 175 psig, 325°F.

2.5 FIXED-PLATE TOTAL HEAT EXCHANGERS

A. Plates: Evenly spaced and sealed and arranged for counter airflow.

1. Plate Material: Chemically treated paper with selective hydroscopicity and moisture permeability, and gas barrier properties.

B. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers.

2.6 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Provide filter holding frames arranged for flat or angular orientation as noted, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum where indicated.

4. Comply with requirements of Division 23 sections.

5. Provide filters as indicated on the drawings.

B. Filter Gage:

1. 3-1/2-inch-diameter, diaphragm-actuated dial in metal case.

2. Vent valves.

3. Black figures on white background.

4. Front recalibration adjustment.

5. 2% of full-scale accuracy.

6. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch tubing, and two- or three-way vent valves.

2.7 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, Laboratory Methods for Testing Dampers for Rating, shall not exceed 2% of air quantity at 2,000-fpm face velocity through damper and 4-inch wg pressure differential.

B. Damper Operators: Comply with requirements in Specification Section 23 09 00, Building Automation System for HVAC.

C. Outdoor- and Return-Air Dampers: Double-skin airfoil parallel-blade or opposed blade, galvanized-steel or aluminum dampers mechanically fastened to cadmium-plated steel operating rod in reinforced cabinet.

2.8 ELECTRICAL

A. Single-Point Power Connection: Provide a single point power connection for all unit electrical components. Select the power connection for the voltage and phase of the fan motor. Provide a transformer as required for all lower voltage equipment. Provide a non-fused disconnect to disconnect the incoming power feed.

B. Fused Disconnects: Provide individual fused disconnects for each piece of electrically driven equipment such as fans, electric heaters, etc. Locate disconnect outside of unit adjacent to the door where component is located.

C. Service Light: 100-watt vaporproof fixture or magnetically attached LED light with switched junction box located outside adjacent door.

1. Locations: Minimum of one light per section.

2. Lights may be controlled via a common switch if switch is provided with a pilot light.

2.9 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA Standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C1071, Type I or II.

b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C916, Type I.

b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by the manufacturer and without causing leakage in cabinet.

c. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

d. Liner Adhesive: Comply with ASTM C916, Type I.

B. Curb Height: 14 inches.

2.10 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data. Test fans according to AMCA 300, Reverberant Room Method for Sound Testing of Fans. Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to ARI Guideline B. Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 specifications. Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Arrange installation of units to provide access space around units for service and maintenance.

C. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

D. Duct installation requirements are specified in other Division 23 sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.

2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3. Install exhaust- and return-air duct continuously through roof structure.

E. Comply with requirements for piping specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings, and specialties.

F. Install piping adjacent to air-handling unit to allow service and maintenance.

G. Condensate Drain Piping: Comply with applicable requirements in Specification Section 23 21 15, HVAC Drain Piping. Connect condensate drain pans, extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

H. Coil Water Piping: Comply with applicable requirements in Specification Section 23 21 13, Hydronic Piping. Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Specification Section 23 21 13, Hydronic Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

3.3 CLEANING

A. Filters:

1. Install temporary disposable filters, minimum MERV-8, prior to start-up or operating equipment during construction.

a. Replace temporary filters when pressure drop across the filter reaches the filter manufacturer’s recommended dirty-filter pressure.

2. After completing system installation and start-up, and immediately prior to testing, adjusting and balancing activities, clean filter housings and replace disposable filters with the filters indicated.

3. After final building cleaning or upon substantial completion, whichever is later, clean filter housings and replace disposable filters with the filters indicated.

END OF SECTION

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SECTION 23 81 26

SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions and project elevation.

3. Equipment dimensions and weights.

4. Required clearances.

5. Electrical Data:

a. Motor horsepower.

b. Voltage/Phase/Hz.

c. Full load ampacity, minimum circuit ampacity and maximum overcurrent protection device requirements.

d. Electrical service point(s) of connection.

e. AIC rating of the equipment.

6. Materials of construction.

7. Accessories and options.

8. Controls.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, Safety Standard for Refrigeration Systems.

2. Applicable requirements in the latest edition of ASHRAE 62.1, Section 4 - Outdoor Air Quality, Section 5 - Systems and Equipment, Section 6 - Procedures, and Section 7 - Construction and System Start-Up.

C. ASHRAE/IESNA Compliance: Applicable requirements in the latest edition of ASHRAE/IESNA 90.1.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:

1. Ductless Units:

a. Carrier Corporation.

b. Daikin.

c. Fujitsu General America, Inc.

d. Lennox International Inc.

e. LG Electronics.

f. Mitsubishi.

g. Panasonic Corporation.

2.2 DUCTLESS INDOOR UNITS

A. Wall-Mounted and Ceiling-Suspended Evaporator-Fan Components:

1. Cabinet: Zinc-coated steel chassis with removable, white, enameled steel or plastic panels on front and ends, with rear outside air intake.

2. Insulation: Faced, fiberglass duct liner.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.

4. Fan: Direct drive, centrifugal.

5. Fan Motors: Open drip-proof, permanently lubricated ball bearing, multi-speed with overload protection.

6. Disconnect: Provide unit-mounted disconnect switches (unless power is supplied from the outdoor unit).

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in the latest edition of ASHRAE 62.1.

8. Filters: Provide filter rack with factory-supplied cleanable filter.

9. Condensate Drain Pans:

   a. Fabricated with slope to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and direct water toward drain connection.

   b. Provide condensate pump with overflow switch to shut off the unit in case of pump malfunction.

10. Air Discharge: Front discharge with horizontal air sweep.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls. Controls shall permit operation in cooling mode down to 25°F and heat pump operation down to 15°F.

B. Casing: Steel, finished with baked enamel with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

C. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Scroll or variable-speed scroll as indicated.

2. Refrigerant Charge: R-407c or R-410A as scheduled.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240.

D. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

E. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including sub-cooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.

F. Fan: Aluminum propeller type, statically and dynamically balanced directly connected to motor.

G. Motor: Totally enclosed permanently lubricated, with integral thermal-overload protection.

2.4 ACCESSORIES

A. Thermostat: Low-voltage, wall-mounted, 7-day programmable type to control compressor and evaporator fan, with the following features:

1. Compressor time delay.

2. 24-hour time control of system stop and start.

3. Liquid-crystal display indicating temperature, setpoint temperature, time setting, operating mode, and fan speed.

4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Condenser coil hail guards to protect coil from damage.

D. Field-Installed Hot-Gas Bypass Where Scheduled: Consisting of Rawall APR control valve installed to bypass hot refrigerant gas around the compressor. Install on first stage of cooling on units with multiple refrigerant circuits. Provide manual isolation valve on each side of APR.

E. Low Ambient Kit: Permits operation down to 10°F where scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer’s standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Division 03 specifications. Coordinate anchor installation with concrete base.

D. Install roof-mounted, compressor-condenser components on equipment supports installed in accordance with Division 07 specifications. Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

A. Install and connect refrigerant piping in accordance with Specification Section 23 23 00, Refrigerant Piping, to component’s quick-connect fittings. Install piping to allow access to unit.

B. Condensate Drainage Connections: Comply with applicable requirements in Specification Section 23 21 15, HVAC Drain Piping.

C. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

D. Duct Connections: Duct installation requirements are specified in Specification Section 23 31 13, Metal Ducts. Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Specification Section 23 33 00, Air Duct Accessories.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 CLEANING

A. Filters:

1. Install temporary disposable filters, minimum MERV-8, prior to start-up or operating equipment during construction.

a. Replace temporary filters when pressure drop across the filter reaches the filter manufacturer’s recommended dirty-filter pressure.

2. After completing system installation and start-up, and immediately prior to testing, adjusting and balancing activities, clean filter housings, clean and reinstall washable filters, and replace disposable filters with the filters indicated.

3. After final building cleaning or upon substantial completion, whichever is later, clean filter housings, clean and reinstall washable filters, and replace disposable filters with the filters indicated.

3.5 DEMONSTRATION

A. Train the Owner’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

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SECTION 23 82 19

FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes fan-coil units and accessories.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.

2. Rated capacity based on scheduled conditions and project elevation.

3. Equipment dimensions and weights.

4. Required clearances.

5. Electrical Data:

a. Motor horsepower

b. Voltage/Phase/Hz.

c. Full load ampacity, minimum circuit ampacity and maximum overcurrent protection device requirements.

d. Electrical service point(s) of connection.

e. Wiring diagrams.

6. Materials of construction.

7. Accessories and options.

8. Controls.

B. Warranty information.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - Systems and Equipment, and Section 7 - Construction and Startup.

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/ IESNA 90.1-2004, Section 6 - Heating, Ventilating, and Air-Conditioning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the drawings or comparable product by one of the following:

1. Carrier Corporation.

2. Daikin.

3. Enviro-tec.

4. International Environmental Corp.

5. Trane; American Standard Inc.

6. York International Corporation.

2.2 FAN-COIL UNITS

A. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

B. Coil Section Insulation: Minimum 1/2-inch-thick, coated-glass fiber, foil-covered, closed-cell foam, or matte-finish, closed-cell foam complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

C. Main and Auxiliary Drain Pans: Plastic or stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1-2004. Provide condensate overflow switch wired to shut off unit in case of condensate drain malfunction.

D. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

E. Cabinet: Steel with baked-enamel finish.

1. Vertical Unit Front Panels: Removable, steel, with discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.

2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with discharge grilles.

3. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

F. Filter Rack: Galvanized steel or steel with baked-enamel finish, channel designed to support filter in the return airstream.

G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated Cotton-Polyester Media: 1 inch thick, 90% arrestance, and 7 MERV.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins maximum of 12 fins per inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220°F. Include manual air vent and drain valve.

I. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor.

2. Motor: Permanently lubricated, multi-speed; resiliently mounted on motor board. Comply with requirements in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

3. Wiring Termination: Connect motor to chassis wiring with plug connection.

J. Factory Hydronic Piping Package: ASTM B88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211°F. Tag hose kits to equipment designations.

a. Hose Material: Reinforced synthetic rubber.

b. Exterior Cover: Braided stainless steel.

c. Couplings: Solid brass or stainless steel.

d. Length: 24 inches.

e. Minimum Diameter: Equal to fan-coil-unit connection size.

2. Two-Piece Ball Valves: Brass body with full-port, chrome-plated brass ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

3. Two-way, modulating control valve for chilled-water coil.

4. Two-way, modulating control valve for heating coil.

5. Calibrated-Orifice Balancing Valves: Brass body, ball type; 125-psig working pressure, 250°F maximum operating temperature; with calibrated orifice or venturi, connections for portable differential-pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.

6. Two-way, modulating pressure-independent control valve for chilled-water coil.

7. Two-way, modulating pressure-independent control valve for heating coil.

8. Y-Pattern Hydronic Strainers: brass body; 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.

9. Wrought-Copper Unions: ASME B16.22.

K. Control devices are specified in Specification Section 23 09 00, Building Automation System for HVAC.

L. Basic Unit Controls:

1. Control voltage transformer.

2. Unit-mounted disconnect switch.

M. Electrical Connection: Factory wire motors and controls for a single electrical connection.

2.3 DUCTED FAN-COIL UNITS

A. Description: Factory-packaged and -tested units rated according to ARI 430, ASHRAE 33, and UL 1995.

B. Casing Insulation: 1-inch-thick coated-glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

C. Drain Pans: Plastic or stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1-2004. Provide condensate overflow switch wired to shut off unit in case of condensate drain malfunction.

D. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.

E. Cabinets and Structural Components: Galvanized steel or steel with baked-enamel finish.

1. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.

2. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

F. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 as noted on the drawings.

G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins maximum of 12 fins per inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220°F. Include manual air vent and drain.

H. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multi-speed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

I. Belt-Driven Fans: Double width, forward curved, centrifugal dynamically balanced; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet.

1. Motors: Comply with requirements in Specification Section 23 05 13, Common Motor Requirements for HVAC Equipment.

J. Factory Hydronic Piping Package: ASTM B88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211°F. Tag hose kits to equipment designations.

a. Hose Material: Reinforced synthetic rubber.

b. Exterior Cover: Braided stainless steel.

c. Couplings: Solid brass or stainless steel.

d. Length: 24 inches.

e. Minimum Diameter: Equal to fan-coil-unit connection size.

2. Two-Piece Ball Valves: Brass body with full-port, chrome-plated brass ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

3. Two-way, modulating control valve for chilled-water coil.

4. Two-way, modulating control valve for heating coil.

5. Calibrated-Orifice Balancing Valves: Brass body, ball type; 125-psig working pressure, 250°F maximum operating temperature; with calibrated orifice or venturi, connections for portable differential-pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.

6. Two-way, modulating pressure-independent control valve for chilled-water coil.

7. Two-way, modulating pressure-independent control valve for heating coil.

8. Y-Pattern Hydronic Strainers: Brass body; 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.

9. Wrought-Copper Unions: ASME B16.22.

K. Control devices are specified in Specification Section 23 09 00, Building Automation System for HVAC.

L. Basic Unit Controls:

1. Control voltage transformer.

2. Motor contactor and disconnect switch.

M. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan-coil units to comply with NFPA 90A.

B. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Specification Section 23 05 48.13, Vibration Controls for HVAC Piping & Equipment.

C. Piping installation requirements are specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.

2. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.

a. Maximum Hose Bend: Do not exceed 180 degrees.

b. Maximum Pipe Offset: Not to exceed 3 inches.

c. Comply with manufacturer’s written limitations and instructions.

3. Connect condensate drain to indirect waste.

a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

D. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Specification Section 23 33 00, Air Duct Accessories. Comply with safety requirements in UL 1995 for duct connections.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING

A. Filters:

1. Install temporary disposable filters, minimum MERV-8, prior to start-up or operating equipment during construction.

a. Replace temporary filters when pressure drop across the filter reaches the filter manufacturer’s recommended dirty-filter pressure.

2. After completing system installation and start-up, and immediately prior to testing, adjusting and balancing activities, clean filter housings and replace disposable filters with the filters indicated.

3. After final building cleaning or upon substantial completion, whichever is later, clean filter housings and replace disposable filters with the filters indicated.

END OF SECTION

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DIVISION 26

ELECTRICAL

END OF INDEX

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SECTION 26 05 00

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

A. Provisions of this section apply to all work specified in all sections under Division 26.

B. In addition, work in Division 26 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections in Division 01 specifications.

C. The drawings and specifications do not specify exact installation means and methods or Contractor safety procedures. Installation means and methods and safety procedures are, and shall remain, the responsibility of the Contractor. No instruction or statement made on the drawings, specifications, future addenda, or change orders shall be interpreted to shift this responsibility away from the Contractor.

D. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions. Where the word “provide” or “provision” is used, it shall be definitely interpreted as “furnishing and installing complete in operating condition.” Where the words “as indicated” or “as shown” are used, they shall mean “as shown on the Contract Drawings.” Where items are specified in the singular, this division shall provide the quantity as shown on the drawings, plus any spares or extras mentioned on the drawings or in the specifications. All specified and supplied equipment shall be new.

1.2 DEFINITIONS

A. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include tunnels, trenches, hollow perimeter construction, above exterior furred spaces, and exterior suspended ceilings.

B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in duct shafts, and within hollow construction.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations, under canopies, and equipment yards.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include unfinished spaces, mechanical, electrical, and communication equipment rooms, and other areas solely for maintenance and repair.

E. Exposed: Not concealed.

F. Finished Space: A space other than mechanical, electrical, and communication equipment rooms, crawlspaces, and utility tunnels. Not an unfinished space.

G. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel. A room noted on the “Finish Schedule” with exposed and unpainted construction for walls, floors, or ceilings, or specifically mentioned as “unfinished.”

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and project conditions, and pay all costs necessary to perform the work.

1.4 ELECTRICAL CONTRACTOR

A. The Electrical Contractor shall be licensed as such in the state governing the project location. This license shall remain valid for the duration of the contract and shall have been valid for a minimum of 2 years prior to the contract award date.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01 specifications.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01 specifications.

1.6 DRAWINGS AND SPECIFICATIONS

A. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be contract documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

B. Product Information Sheets: Provide manufacturer’s literature which includes the information required by the Product Data paragraph of the applicable specification section. Where product information sheets show multiple models or options, clearly mark the model and options to be provided.

C. Assembly: Assemble all required submittal information for each specification section and submit in PDF format.

1. Assemble PDF submittals in one PDF file for each division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.

2. Partial submittals will be returned without review. Partial submittals and submittals that are not project specific will be returned without review.

D. Identification and Information:

1. Name the PDF file with the project name, division number, and sequential submittal number (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2).

2. Provide a cover sheet at the front of each submittal with the following information:

a. Project name.

b. Date.

c. Name of Engineer.

d. Name of Contractor.

e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

a. Name of supplier.

b. Name of manufacturer.

c. Number and title of appropriate specification section.

d. Drawing number and detail references, as appropriate.

e. Other necessary identification.

E. Options:

1. Identify options requiring selection by the Engineer.

2. Identify options included with submittal item.

F. Deviations: Identify deviations in a line-by-line comparison format to the Contract Documents and include as a cover sheet to the product submittal. Include statement(s) and documentation supporting the acceptability of the deviation.

G. Furnished by Others: This project is to provide a complete and functional system. Where material or labor is indicated in the submittal to be provided “by others,” clearly indicated who is providing those items and include information to indicate proper coordination.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current Material Safety Data Sheets (MSDS) for all hazardous chemicals that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of 1 week prior to the delivery of any hazardous chemicals to the site.

2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the Contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.

B. A properly prepared RFI shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specifications in need of clarification and the nature of the clarification requested.

1. Drawings shall be identified by drawing number and location on the drawing sheet.

2. Specifications shall be identified by section number, page, and paragraph.

C. Include a proposed solution, where appropriate, based on the field conditions and best knowledge of the Contractor.

1.10 AS-BUILT DRAWINGS

A. As-Built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings.

1. Preparation: Mark As-Built Drawings to show the actual installation where installation varies from that shown originally. Include all equipment, and underground and overhead conduit.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Include dimensions both horizontally and vertically to permanent points of reference, accurate within 6 inches. Include descriptors such as "below slab," "above ceiling," etc.

c. Record data daily or as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.

2. Mark the As-Built Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of the As-Built Drawings.

3. Mark the As-Built Drawings with erasable, red colored pencil, or in a digital PDF format using an editor program such as Bluebeam, Adobe Acrobat Professional, or similar. Use other colors to distinguish between changes for different categories of the work at the same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

5. Update the As-Built Drawings weekly or daily as appropriate for the project size.

B. Format: Identify and date each As-Built Drawing; include the designation "PROJECT AS-BUILT DRAWING" in a prominent location.

1. Organize newly-prepared As-Built Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification, as follows:

a. Project name.

b. Date.

c. Designation "PROJECT AS-BUILT DRAWINGS."

d. Name of Engineer.

e. Name of Contractor.

3. Remove or obscure the Engineer's seal and signature from As-Built drawings.

C. Building Information Model: Prepare and maintain an up-to-date building information model throughout the project.

1. Prepare a building information model at the beginning of construction, using the latest version of Autodesk REVIT software.

2. Use manufacturer-prepared families wherever they are available for the actual equipment used on the project. Include manufacturer's name, model number, serial number, and include links to operation and maintenance information.

3. Update the information contained in the model as the project progresses.

4. Deliver the updated model and all support files to the Owner at the completion of the project.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment Operation & Maintenance Manual for all equipment supplied under Division 26.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to Substantial Completion for review and comment.

2. Submit the final version of the manual not more than 4 weeks after Substantial Completion of the project.

C. Format: Submit manuals in the following format:

1. PDF Electronic File: Assemble for each system and piece of equipment, a manual with a composite PDF file, electronically indexed. Provide a system table of contents file with hyperlinks to each of the individual equipment PDF files. Submit on digital media acceptable to the Engineer.

a. Name each indexed document file in the composite electronic index with the applicable item name. Include a complete electronically-linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

c. Provide an updated final copy, inclusive of all review comments, to the Engineer and Owner.

D. Provide Operation & Maintenance Manuals for all systems, subsystems, and equipment that require operation and regular maintenance, or have replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturer's maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this section, include operation and maintenance data required in individual specification sections.

F. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match the manual's table of contents. For each product, list the name, address, and telephone number of the installer or supplier and maintenance service agent, and cross-reference the specification section number and title in the Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on the Contract Documents.

2. Approved submittals.

3. Include the following if not shown on approved submittals:

a. Product name and model number. Use designations for products indicated on the Contract Documents.

b. Manufacturer's name.

c. Equipment identification with serial number of each component.

d. Equipment function.

e. Operating characteristics.

f. Limiting conditions.

g. Performance curves.

h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures, including precautions against improper use.

10. Operating logs.

I. Wiring Diagrams: Diagram of factory-installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Manufacturer's Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

L. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

M. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

N. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

O. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

P. Licenses: Include copies of any licenses with requirements, including inspection and renewal dates.

Q. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

R. Test Reports: Include a final approved copy of the factory and field testing reports.

1.12 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. The Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of the same type or classification by the same manufacturer.

1.13 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 specifications for description of material and equipment for prior approvals and substitutions.

1.14 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. Refer to Division 01 specifications for additional requirements.

B. Cooperative work includes:

1. General supervision and responsibility for proper location, rough-in, and size of work related to Division 26 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts, and anchor bolts for work under sections in Division 26.

3. Sealing of penetrations through fire and smoke barriers caused by work installed as part of Division 26.

1.15 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be re-used or retained by the Owner, all other materials indicated to be removed shall be removed and disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused raceways, conductors, boxes, equipment, and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible raceways, conductors, boxes, equipment, and miscellaneous materials shall be removed and sealed or capped within wall, below floor, unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining electrical and control service to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Architect and Owner.

D. Disconnect, demolish, and remove electrical systems, equipment, and components that are indicated to be removed.

1. Conduit to be Removed: Remove portion of conduit indicated to be removed and cap or plug remaining conduit with the same or compatible conduit material. Patch insulation, as required, to match adjacent areas.

2. Conduit to be Abandoned In Place: Cap or plug conduit with the same or compatible conduit material.

3. Equipment to be Removed: Disconnect services and remove equipment.

4. Equipment to be Removed and Reinstalled: Disconnect and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to be Removed and Salvaged: Disconnect and remove equipment and deliver to the Owner.

E. Continuity of Services in Existing Building: The Contractor shall permanently reroute existing electrical and control services or provide temporary connection as required to maintain service to existing receptacles, fixtures, and equipment in the building which are to remain in service.

F. Rerouting and Relocation of Existing Electrical Equipment and Services in Existing Building:

1. General: The Contractor shall reroute/relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.

2. Existing Raceways and Conductors: Where applicable, existing material may be re-used in its original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If, for any reason, these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.16 GUARANTEE

A. Guarantee in writing all material, equipment, installation, and workmanship for all sections under Division 26 to be free from defects of material and workmanship for 1 year from date of final acceptance as outlined in Division 01 specifications. Equipment warranties shall be a minimum of 1 year from date of Substantial Completion or as specified elsewhere. Refer to the specific product specification section for additional warranty terms. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required.

1.17 ELECTRICAL WIRING

A. Provide all line voltage power wiring, line voltage interlock wiring, and line voltage control wiring for the equipment that is to be provided under Divisions 21, 22, and 23 unless wiring is specifically shown on the electrical drawings.

B. The following schedule is intended to summarize the division of work material responsibilities between the Mechanical Contractor, Controls Contractor, and Electrical Contractor.

Item	Furn. By	Set By	Power Wiring	Control Wiring
Equipment Motors	MC	MC	EC	--
Motor Control Center	EC	EC	EC	CC
Motor Starters, Controllers, Contactors, and Overload Heaters	MC*	EC**	EC	CC
Fused and Non-Fused Disconnect Switches	EC	EC	EC	--
Manual Operating Switches, Multi-Speed Switches, Pushbutton Stations, and Pilot Lights	CC	CC	CC	CC
Control Relays and Transformers	CC	CC	CC	CC
Line Voltage Thermostats and Time Switches***	MC	MC	EC	EC
Low-Voltage Thermostats	MC	MC	--	MC
Temperature Control Panels	MC	MC	EC	CC
Smoke Detectors (Duct Mounted)	EC	MC	EC	MC or CC
Motor and Solenoid Valves, Damper Motors, PE and EP Switches	CC	MC	CC	CC
Water Treatment Equipment	MC	MC	EC	CC
MC = Mechanical Contractor CC = Controls Contractor EC = Electrical Contractor				
*Except where such devices are located in MCCs.				

Item	Furn. By	Set By	Power Wiring	Control Wiring
**Unless required by these specifications to be provided as part of a factory-furnished assembly (i.e., fan coils, air handlers, chillers, etc.). ***Motor-drive units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches, or time switches which conduct full load current of the motor shall be wired for both power and control under the electrical contract.				

1.18 CONNECTIONS TO UTILITY SYSTEMS

A. Provide connections to serving utility companies, including, but not limited to, power and telephone as indicated on the plans. Contact utility companies and obtain the final design plans. Coordinate equipment, installation, and inspections with the serving utility. The Contractor shall include contact, coordination, inspections, utility company fees, and work described on the serving utility design plans as part of the work of this contract.

B. Where the utility company's final design plans are not available at the time of bid, the Contractor shall include a $5,000 allowance. This allowance shall apply to work required by the utility company's final design plans not delineated in the Contract Documents. Any excess allowance remaining at Project Closeout shall be returned to the Owner. Any deficient allowance shall be billable to the Owner.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Where used for structures to be provided under the contract such as bases, pole bases, etc., concrete work and associated reinforcing shall be as specified under that division.

B. Refer to other sections for additional requirements for underground vaults, duct banks, etc.

2.2 FRAMING CHANNEL

A. The framing channel shall be a cold-rolled, high-quality, carbon-steel channel with factory-applied, hot-dipped-after-fabrication galvanized finish. Utilize factory-built interconnecting components, mounting straps, connectors, etc., designed for use with the framing channel supplied. Channel nuts shall be spring type and shall utilize standard SAE threads. Provide heavy zinc paint for field touchup. B-Line "B" Series, Unistrut "P" Series, or as accepted by the Architect.

2.3 ROOFTOP SUPPORTS

A. Where specifically allowed by Part 3, provide pyramid-style composite support base for conduit, cable tray, and equipment. Support base shall made of a UV-stabilized composite thermoplastic material or UV-resistant rubber and include hot-dip galvanized-steel attachment components. Rubber support base must include a steel load distribution top plate or strut. Support base shall include a low abrasion interface between the base and roof membrane for roof membrane protection. The base thermoplastic or rubber shall be made of 100% recycled material.

B. Support base shall not have sharp edges and shall be compatible with project roof surfaces including single ply, bituminous, rubberized membrane, metal, and spray foam.

C. Manufacturer and Product: nVent/Erico Caddy “Pyramid Base” Series, Eaton “Dura-Blok” Series, or as accepted.

2.4 ANCHORS

A. Anchors shall be expandable-lead type, as manufactured by Ackerman-Johnson, Diamond, Hilti, Pierce, or as accepted by the Architect.

B. Adjustable concrete hanger inserts shall be as manufactured by Grinnell, or as accepted by the Architect.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, and Architect.

B. Submit one copy of PDF submittals via email, project website, or other electronic media.

3.2 AS-BUILT DRAWINGS AND RECORD DOCUMENTS

A. Recording: Post changes and modifications to the As-Built Drawings as they occur; do not wait until the end of the project.

B. Maintenance of As-Built Drawings and Record Documents: Store Record Documents in the field office, apart from the Contract Documents used for construction. Do not use project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project Record Documents for the Engineer’s reference during normal working hours. As-Built Drawings will be reviewed by the Architect, Owner, and Engineer at each pay request review.

C. Submit As-Built Drawings to the Architect at completion of the project.

3.3 OPERATION & MAINTENANCE MANUALS

A. Prepare Operation & Maintenance Manuals as directed.

B. Submit a preliminary electronic copy of the Operation & Maintenance Manual to the Engineer for review.

C. Upon receipt of comments, make any corrections noted from the Engineer’s review and resubmit as required.

D. Submit the final, corrected Operation & Maintenance Manual in electronic format to the Architect.

3.4 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at the site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

3.5 EQUIPMENT LAYOUT

A. Drawings are diagrammatic and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best sequence and installation methods, exact locations, feeder and branch circuit routes considering building obstructions and other project limitations.

B. All equipment furnished with connections in the required locations shall fit the space available and include adequate space for operating and servicing.

C. Install apparatus and equipment in a manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

D. Do not install conduit runs or cable trays in front of or directly below any portion of the equipment access areas where access would be blocked by the installation.

E. Do not install conduit runs or cable trays in the path of equipment removal for repairs and or maintenance.

3.6 CUTTING AND PATCHING

A. Cut work and patch per Division 01 specifications as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary steel to support electrical equipment and raceways between structural steel unless shown on the structural drawings.

3.7 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested, and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested, and approved, restore all work to original proper condition.

3.8 ACCESSIBILITY

A. Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the Contract Drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Electrical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, control transformers, relays, power packs, and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified in Division 08 specifications.

C. Refer to the architectural drawings for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to avoid unnecessary duplication of access doors.

E. Provide doors that pierce a fire separation with the same fire rating as the separation.

3.9 ROOF FLASHINGS

A. Flash and counterflash all raceways penetrating roofing membrane with flashing per roofing manufacturer's recommendations. Refer to the architectural drawings for detailing of raceway penetrations through roof.

3.10 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, detectors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

C. Install equipment and raceways level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install electrical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment and raceways to allow right-of-way for access to removable panels and service points. This applies to equipment of all disciplines.

F. Do not install any equipment in an application not recommended by the manufacturer.

3.11 EQUIPMENT ROUGH-IN

A. Rough-in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from stated architectural dimensions, large-scale architectural plans and elevations, and vendor drawings. The Contractor shall obtain all rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the Contract Drawings shall be anticipated and provided for under this division.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all raceway, conduit, and conductors. Cap all conduit stubouts in a manner suitable for future extension.

3.12 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment (refer to Division 01 specifications) and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Obtain rough-in drawings from the Owner or other contractors, prior to roughing-in any services.

C. Provide all services required. Cap all conduit and raceways and leave in a clean and orderly manner.

3.13 EQUIPMENT FINAL CONNECTIONS

A. Provide all final connections for the following:

1. All equipment furnished under this division.

2. Electrical equipment furnished under other sections of the specifications (except as otherwise designated).

3. Owner-furnished equipment as shown on the drawings.

3.14 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

A. All electrical wiring including power wiring and control wiring (except as specified in Divisions 21, 22, and 23), including all raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment, shall be included in this section of the specifications.

B. Wiring diagrams, complete with all connection details, shall be furnished under each respective section.

C. Provide all connections as described per Divisions 21, 22, and 23.

3.15 EQUIPMENT SUPPORTS

A. Erection of Metal Supports and Anchorages:

1. Refer to Division 05 specifications for structural steel.

2. Design, cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

3. Field Welding: Comply with AWS D1.1.

B. Erection of Wood Supports and Anchorages:

1. Design, cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor electrical materials and equipment.

2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

3. Attach to substrates as required to support applied loads.

C. Where supports, foundations, suspended platforms for transformers, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment stresses and interference with conduit connections, service panel removal, or other maintenance operations.

2. Regarding equipment of other disciplines, locate support members to avoid interference with duct, conduit, and piping connections, control connections, service panel removal, or other maintenance operations.

D. Rooftop supports shall not be used for conduit unless specifically noted on the plans. Where used, coordinate acceptability of support to membrane interface with roof membrane manufacturer and provide accordingly.

E. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 26.

F. Concrete Bases: Work under this section includes coordination of construction of all concrete foundations indicated or required for equipment specified under Division 26. Materials and workmanship shall be described in Division 03 specifications. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at project.

1. Construct concrete bases of dimensions indicated, but not less than 1 inch (25 mm) larger in both directions than supported unit footprint. Where servicing apparatus for drawout circuit breakers requires a level surface in front of the switchboard or switchgear, coordinate pad front extension so as to allow service to occur using standard apparatus. Where utility company connections and equipment occur, pads below underground pull section, meter, and main switch(es) shall conform to the serving utility requirements.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extends through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's installation drawings, templates, diagrams, and instructions to locate anchors. Install anchor bolts to elevations and embedment depths required for proper attachment to supported equipment.

5. Install anchor bolts at elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

G. Grouting:

1. Grout under lighting pole base plate after leveling, filling completely the space between base plate and foundation surface as specified in Division 03 specifications.

2. Mix and install grout for electrical equipment base bearing surfaces and other equipment base plates, and anchors.

3. Clean surfaces that will come into contact with grout.

4. Provide forms as required for placement of grout.

5. Avoid air entrapment during placement of grout.

6. Place grout, completely filling equipment bases.

7. Place grout on concrete bases and provide smooth bearing surface for equipment.

8. Place grout around anchors.

9. Cure placed grout.

10. Finish exposed surface of grout for a neat appearance.

3.16 CLEANUP

A. In addition to cleanup specified in Division 01 specifications, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. During the progress of the work, keep the premises clean and free of debris.

3.17 PAINTING

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal with one coat of rust-inhibiting primer. Galvanized and factory-painted equipment shall be considered as having primed surface.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Finished painting is specified in Division 09 specifications.

3.18 FIRESTOPPING

A. Coordinate with the firestopping installer for sealing of all penetrations of fire and smoke barriers and other rated assemblies created during the installation of the Division 26 work.

3.19 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through conduit, sheet metal work, or the building structure.

3.20 TESTING

A. Upon completion of the electrical work, the entire installation shall be tested and demonstrated to be operating satisfactorily. Tests and documentation shall be in accordance with NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

B. Tests, calibrations, and settings shall include the following:

1. Wiring shall be tested for continuity, short circuits, and/or accidental grounds. All systems shall be entirely free from grounds, short circuits, and any or all defects.

2. Motors shall be operating in proper rotation and control devices shall be functioning properly. Check all motor controllers to determine that properly sized overload devices are installed. Check all electrical equipment for proper operation.

3. Insulation resistance test for all switchboard buses, bus ducts, motor and feeder conductors, including neutrals, using a megohmeter. Apply to each conductor and maintain for 15 seconds or until reading stabilizes. Minimum value for each conductor shall be 20 megohms at 30°C. This test shall be performed by an independent testing company.

4. Test, calibrate, and set all relays, circuit breaker trip devices, and ground fault protection trip units after receipt of engineered settings. Circuit breaker setups shall be performed or witnessed by a qualified representative of the circuit breaker manufacturer. This representative shall be identified by name and shall initial related test report(s).

5. Additional equipment-specific testing is described in the equipment's respective section of this division.

C. Furnish a written report of testing to the Architect. At a minimum, the report shall include:

1. Testing Contractor's letterhead.

2. Testing technician's name and signature.

3. Date and time that test was performed.

4. Ambient temperature and weather conditions.

5. Test equipment manufacturer, model number, and last calibration date.

6. The manufacturer, model number and, as applicable, trip unit model number and available adjustments of tested equipment.

7. Statement of "As Left" conditions.

8. Pass/Fail statement relative to NETA Chapter 10 recommendations.

9. Recommendations if any.

D. The Contractor shall submit the testing schedule to the Architect 2 weeks prior to initiation of testing activity.

E. Ground fault protection (GFP) trip units shall be calibrated and tested prior to energizing any equipment served by GFP devices.

F. The Contractor shall furnish the necessary instruments and labor required for testing, calibration, and implementation of engineered settings.

G. Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation shall be provided by local inspection authorities.

H. Any equipment or wiring provided, which through testing proves to be defective or operating improperly, shall be corrected or replaced promptly, at no additional cost to the Owner.

END OF SECTION

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SECTION 26 05 01

SCOPE OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. The work under this division includes furnishing all labor, material, and equipment necessary for the installation of and placing into operation the electrical systems as indicated on the drawings.

B. The work shall also include the completion of such minor details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the drawings or required by these specifications.

1.2 SCOPE

A. The work includes, but is not necessarily limited to, furnishing and installing the following:

1. Complete power and lighting systems, service switchboards, distribution switchboards, distribution panelboards, branch circuit panelboards, safety switches, feeders, branch circuits, lighting fixtures, lamps, controls, and accessories.

2. Motor and power wiring for all motors and/or equipment furnished under the Contract. Except as otherwise specified to be furnished by or under other divisions of these specifications, all wiring devices, starter wiring, conduit, feeders, control wiring, accessories, and final connections to all equipment shall be furnished under this section.

3. Install controls for all equipment except as specified under the automatic temperature control system.

4. All equipment and materials specified in this division.

5. Empty conduits for connections to serving utility companies, including, but not limited to, power and telephone. Provide concrete pads, trenching, and installation as required by and conforming to the specifications of the serving utility.

6. Empty conduit systems as indicated on the drawings.

7. All other items and/or work indicated on the drawings.

8. Equipment lists and maintenance manuals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 26 05 02

TEMPORARY & REMODELING WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Perform all temporary and remodeling work as shown on the drawings and described in the specifications, including minor items of material or equipment necessary to meet the requirements and intent of the project.

B. All temporary and remodeling work shall be considered a part of this contract and no extra charges will be allowed.

C. Examine architectural, structural, and mechanical drawings and specifications to determine the sequence of construction throughout the project, including existing, temporary, remodeled, and new areas.

D. Where drawings indicate existing conditions, an attempt has been made to show electrical equipment, buildings, site details, etc., but accuracy cannot be guaranteed. Verify exact location of all conduits, outlets, etc., and all building and site details.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Branch circuits shall be re-used where practical and shall, in addition, be revised as required. Conceal all work where possible. Where exposed work is required in finished areas, use Wiremold or similar raceway system components as approved by the Architect.

B. Existing electrical wiring intended to remain in use but which will be disturbed due to construction changes required by this Contract shall be restored to operating condition, as required and/or directed. Where required, shown, and/or directed, outlets and conduit runs shall be relocated. In some cases, it may be necessary to extend conduits and pull in new wiring or install junction boxes and splice in new wiring, or replace old wiring with new.

C. Outlets from which lighting fixtures, switches, receptacles, and/or other electrical devices are removed and are not intended to be re-used shall be removed or, if it is not possible to remove them, a blank cover shall be placed on the outlet box. Where outlets, boxes, etc., are completely removed, the Contractor shall cut off conduits and remove wiring.

D. Where conduits extending through floors are to be abandoned, the Contractor shall cut and cap or plug conduit so that it will not protrude above the floor.

E. Where existing conduit is to be abandoned, the conduit shall be removed if it is exposed, in a crawl space, or in an accessible ceiling. Where it is impossible to remove the conduit, it shall be cut off and capped or plugged.

F. The Contractor shall be held fully responsible for the proper restoration of all existing surfaces requiring patching, plastering, painting, and/or other repair due to the installation of electrical work under the terms of this specification. Close all openings, repair all surfaces, etc., as required.

1. The Contractor shall employ qualified and experienced workmen for this work. All restoration work shall be subject to the approval of the Architect and/or the Owner.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install wire and cable for branch circuits and feeders as specified herein and as shown on the drawings.

1.2 RELATED SECTIONS

A. Specification Section 26 05 53, Identification for Electrical Systems.

1.3 ACTION SUBMITTAL

A. Submit product data indicating compliance with this specification for each type of conductor and cable.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

A. All wire and cable shall be new, 600-volt insulated, of types specified below for different applications. All wire and cable shall bear the UL label and shall be brought to the project in unbroken packages.

B. Wire and cable 4 AWG size and smaller shall be Type THHN/THWN-2. Wire and cable larger than 4 AWG shall be Type XHHW-2.

C. Wire and cable supplying Divisions 23, 24, and 25 equipment (and similar) shall be Type XHHW-2 regardless of size.

D. Wire for branch circuits connected to isolated power systems shall be Type XHHW, no exceptions.

E. Conductor Material:

1. Annealed copper for all sizes. Encore Wire, General Cable, Southwire, or as accepted.

2. Conductor Stranding:

3. Wire size 14 AWG and larger shall be stranded.

F. Wire Pulling Lubricant:

1. American Colloid “Slip X-300.”

2. American Polywater A, C, G, & J.

3. Electro “Y-er Eas.”

4. Ideal “Wire Lube.”

5. Mac “Wirepull.”

6. Minerallac “Wire-Wax.”

7. Quelcor “Quelube.”

8. Richards “Gel Lube 7/5.”

9. Thomas/Jet Line “Slipry Loob.”

G. Metal-clad (MC) cable shall be steel corrugated interlocking type and shall include an equipment ground conductor. AFC, AmerCable, or as accepted. MC cable shall not be permitted to be used on this project unless indicated on the drawings or as noted in PART 3 of this section.

H. Armor-clad (AC) cable shall not be permitted to be used on this project.

I. Mineral insulated cable shall be AmerCable, M.I. Cable Company (MICC), or as accepted.

J. Fire-rated cable assemblies shall be Draka Cableteq “Lifeline RHW” 600-volt copper, or as accepted.

2.2 TERMINATIONS, SPLICES, AND JOINTS

A. Terminations:

1. Locking fork, 600-volt vinyl insulated, butted seam, 3M Scotchlok terminals or as accepted.

2. Ring tongue, 600-volt vinyl insulated, butted seam, 3M Scotchlok terminals or as accepted.

3. Round flange solderless lug. Burndy “Quick-Lug” Type QDA, or as accepted.

4. Solderless lug with water-resistant self-sealing gel cover. RayChem GelCap or as accepted.

5. Solderless compression lug type, one- or two-hole. Blackburn, Burndy, Ilsco, or as accepted.

6. Mechanical lug type listed for the application. Lug shall include an insulating cover. Burndy, Ilsco, or as accepted.

7. Flexible ferrule, copper, 600-volt, non-insulated. Dottie, NSi Industries, or as accepted.

8. Termination of stranded wire 10 AWG or smaller on breakers and wiring devices shall include a captive plate design.

B. Splices and Joints:

1. Pressure-type solderless insulated square spring connectors. 3M Scotchlok, Buchanan BCAP, Ideal Wing-Nut, Ideal Wire-Nut, or as accepted.

2. Solderless mechanical in-line lug with formed insulating cover, 600-volt minimum rating. Material shall be listed for use with the specific conductor material. Blackburn, Burndy, Ilsco, NSi, Panduit, or as accepted.

3. Solderless compression type, long barrel with dimpled center stop and heat- or cold-shrink 600-volt insulation. Splice material shall match conductor material. Blackburn, Burndy, Ilsco, or as accepted.

4. Exterior Below Grade Joints in Wire (specific, case-by-case approval by the Engineer is required):

   a. Pressure-type solderless insulated square spring connectors with self-sealing gel, UL 486D listed. Ideal Underground or as accepted.

   b. Solderless lug, solderless compression lug with watertight self-sealing gel cover. Raychem GelCap or as accepted.

5. Insulative Tape: Self-fusing, ethylene propylene rubber backing and highly conformable, rubber-resin adhesive. Temperature rated for continuous adhesion to 194°F (90°C). 30-mil thickness, voltage rated to 69kV. 3M Scotch 23 or as accepted.

C. Wire Taps: Solderless mechanical or compression lug, irreversible compression "H" tap, each with formed insulating cover or heat/cold-shrink insulation, 600-volt minimum rating. Tap material shall be listed for use with the specific conductor material. Blackburn, Burndy, Ilsco, Raychem Gtap, or as accepted.

2.3 APPLIED INSULATION

A. Insulating materials shall be listed for the application. Voltage rating shall be equal to or greater than the factory-applied wire insulation. 3M, Ilsco, Raychem, or as accepted.

PART 3 - EXECUTION

3.1 GENERAL WIRING

A. Drawings, in general, indicate location of items of equipment. Exact locations of motors and other devices are to be determined in the field by the Contractor. Provide an electrical feed for all equipment, not smaller than shown or NEC size where size is omitted from the drawings, together with a suitable circuit protective device. Verify panel schedules and layout, maintaining number of spare branches indicated.

B. Complete rough-in requirements of all equipment to be wired under the Contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect, as the case may be, for complete and accurate requirements to result in a neat, workmanlike installation.

C. Feeder conductors to distribution equipment shall be adjusted to limit voltage drop. The Contractor shall review the anticipated installed length and confirm the selected feeder results in not more than 2% voltage reduction. Base calculations on the actual load, or where the actual load is not known, 80% of the load side equipment bus rating.

D. Conductors for branch circuit lighting, receptacle, power, and miscellaneous systems shall be as stated in this section. Wire indicated specifically to be larger than the specified minimum shall be increased for the entire length of the circuit.

E. Conductor sizes for lighting, receptacles, and small motor branch circuits with less than a 20-amp connected load are not shown. Conductors for such circuits are sized as follows for a 3% voltage drop to single load. Submit alternate lengths with supporting calculations for review prior to installation.

BRANCH CIRCUITS		
Voltage	Length (from Branch Circuit Panel to Load)	Conductor Size (Not Smaller Than)
120 Volt	66 Feet	No. 12 (16 Amps)
120 Volt	102 Feet	No. 10 (16 Amps)
120 Volt	163 Feet	No. 8 (16 Amps)
120 Volt	256 Feet	No. 6 (16 Amps)
208 Volt	114 Feet	No. 12 (16 Amps)
208 Volt	177 Feet	No. 10 (16 Amps)
208 Volt	283 Feet	No. 8 (16 Amps)
208 Volt	443 Feet	No. 6 (16 Amps)
277 Volt	153 Feet	No. 12 (16 Amps)
277 Volt	236 Feet	No. 10 (16 Amps)
277 Volt	376 Feet	No. 8 (16 Amps)
277 Volt	590 Feet	No. 6 (16 Amps)

3.2 INSTALLATION

A. Wire and cable shall be pulled into conduits without strain, using an approved lubricant.

B. In no case shall wire be re-pulled if same has been pulled out of a conduit run for any purpose.

C. No conductors shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

D. Feeder conductors shall be installed without splicing except where run length is in excess of 500 feet.

E. All connections to wiring devices, circuit breakers, switches, fixtures, motors, and all joints in wires shall be made as noted below:

1. Terminations at Wiring Devices:

a. 12 AWG Solid Wire: Formed around binding post or screw.

b. 14 through 10 AWG Stranded Wire: Locking fork tongue where terminals do not have a captive plate.

c. 8 AWG and Larger: Terminate via splice to device modular connector pigtails.

2. Terminations at Circuit Breakers and Switches:

    a. 14 through 10 AWG Stranded Wire: Locking fork tongue where terminals do not have a captive plate.

    b. 8 AWG and Larger Wire: Where device does not include a captive plate or factory-provided lug, utilize a ring tongue.

    c. 6 AWG and Larger Wire: Round flange solderless lug, Burndy “Quick-Lug” Type QDA or as accepted.

3. Motor Connections: Use the factory-supplied terminal. Where motor is provided without terminals and leads only, provide solderless lug with water-resistant self-sealing gel cover.

4. Joints in Wire:

    a. 8 AWG and Smaller Wire: Pressure-type solderless square spring connectors.

    b. 6 AWG and Larger Wire: Irreversible compression type, long barrel.

    c. Wire Taps: Solderless compression lug, irreversible compression “H” tap. Material shall be listed for use with the specific conductor material.

    d. Exterior Below Grade Joints in Wire (specific, case-by-case approval by the Engineer is required): Solderless lug, solderless compression lug.

        1) 6 AWG and Smaller Wire: Pressure-type solderless square spring connectors with self-sealing gel.

        2) Larger Than 6 AWG Wire: Solderless lug, solderless compression lug with watertight self-sealing gel cover.

5. Other Equipment: Use mechanical lug furnished with the equipment or listed for the application.

6. Solderless connectors NOT used for grounding shall be insulated. Apply wire insulation with voltage rating equal to or greater than the factory-applied wire insulation. Insulate by one of the following methods:

    a. Pre-manufactured insulating caps.

    b. Heat- or cold-shrink insulating sleeve. Shrink in accordance with the manufacturer’s recommendations.

    c. With Engineer Approval Only: One or more layers of ethylene propylene rubber tape, equal in thickness to the conductor insulation installed per the manufacturer’s written instructions.

7. Wire compression-type sleeves or lugs shall be installed with the manufacturer’s recommended tool, in accordance with their published instructions.

8. Termination of finely stranded conductor, such as Type W, shall be made using a flexible ferrule.

9. Each conductor termination shall be tightened to the torque value recommended by the termination manufacturer. Terminations shall be marked once the final torque has been applied. Torque wrenches used for this purpose shall be calibrated and certified per NETA recommendations.

10. Grounding electrode conductor splices and terminations shall be irreversible type.

3.3 COLOR CODING AND MARKING

A. All wiring throughout shall be color-coded as follows:

	480-Volt System	208-Volt System
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral*	Grey	White
Ground	Green	Green
Iso Ground		Green with Yellow Stripe

*Where multiple neutrals are installed within the same raceway, each individual neutral shall be distinctly identified by one or more color stripes.

Where a project includes multiple distribution voltages, each piece of distribution equipment shall be permanently marked with the color code in use. This label shall not be handwritten and must be of sufficient durability for the environment.

B. All control wiring in a circuit shall be color-coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color-coding.

C. Wiring must be color-coded throughout its entire length, except that feeders may have color-coded plastic tape at both ends and all accessible points.

D. At all terminations of control wiring, the wiring shall have a numbered wire marker.

E. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.4 CLAD CABLE ASSEMBLIES

A. Metal clad (MC) cables shall be permitted to be installed on a limited basis, per the following parameters:

1. For branch circuits within architectural millwork.

2. For branch circuits within a single room, originating from a junction box in the above-ceiling space of the room. Branch circuiting supply to the above-ceiling junction box shall be in conduit.

3. As branch circuit “through-wiring” to lighting fixtures installed in gypsum board soffit or other inaccessible areas.

4. For mechanical controls power routed above accessible ceilings.

B. Metal clad (MC) cables shall NOT be used as follows:

1. Where disallowed by NEC 517.31(C)(3).

2. Areas below grade and garage level.

3. To supply mechanical equipment, water heaters not serving a residence, HVAC units, exhaust fans greater than 150 cfm, pumps, etc.

4. Kitchens, laundries, other back-of-house areas below grade.

5. Areas subject to chlorine gas exposure, pool/spa rooms, and related equipment rooms.

C. Metal clad (MC) cable shall be installed with:

1. Anti-shorting devices at each termination.

2. Termination fittings designed and listed for the application.

3.5 FIRE-RATED CABLE ASSEMBLIES

A. Fire-rated cable assemblies shall be permitted where fire-rated cable assemblies are specifically allowed by the NEC. Coordinate use with project Fire/Life Safety Analysis Documents. Provide a copy of listing requirements to the local Authority Having Jurisdiction (AHJ) for inspection during construction. Install according to the listing requirements.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Specification Section 26 05 43, Underground Ducts & Raceways for Electrical Systems.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Specification Section 07 84 13, Penetration Firestopping.

END OF SECTION

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SECTION 26 05 26

GROUNDING & BONDING OF ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install grounding and grounding conductors as specified herein and as shown on the drawings.

1.2 ACTION SUBMITTAL

A. Submit product data indicating compliance with this specification for each type of ground system component.

B. Submit ground system test reports to the Architect for review.

1.3 CLOSEOUT SUBMITTAL

A. Include final ground system test reports in the project Operation & Maintenance Manual.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Stranded copper with 600-volt green insulation.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.

2. Stranded Conductors: ASTM B8.

3. Tinned Conductors: ASTM B33.

4. Bonding Cable: 28 kcmil, 14 strands of #17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: #4 or #6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Ground Busbar: Predrilled rectangular bars of annealed copper, size as noted on the plans, but not less than 1/4-inch thick by 4 inches tall by 24 inches wide. Hole pattern shall be 9/32-inch holes spaced 1-1/8 inches on center or as noted on the plans. Standoff insulators for mounting shall comply with UL 891 for use in switchboards, 600 volts, and shall be Lexan or PVC, impulse tested at 5,000 volts. Standoff insulators shall be minimum 2 inches and mounted using minimum 2-inch steel supports. Assemblies manufactured by Burndy, Ilsco, Blackburn, or as accepted.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory (NRTL) acceptable to Authorities Having Jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Ground Busbar Connectors: Tin-plated copper, two-hole, long-barrel solderless compression.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual tin-plated or silicon bronze bolts.

E. Cable End-to-End Splices: Tin-plated copper, long barrel, end-to-end compression connectors with inspection window. Provide with listed shrink on insulation.

F. Cable Tap Splices: Tin-plated copper, heavy-duty C-tap compression connectors for splices where all conductors are #2 AWG or smaller. Tin-plated copper H-tap compression connectors with insulative cover for all other splices.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy terminal with hex head bolt, listed for direct burial. Manufactured by Burndy, Ilsco, Blackburn, or as accepted.

J. Flexible Ground Straps: Copper, flat-braided type with formed single-hole end pads.

K. Rod and Pipe Clamps: Silicone bronze ground clamp up to 4-inch nominal pipe diameter. Field-welded bonding tabs for two-hole connectors for larger sizes.

2.3 GROUNDING ELECTRODES

A. Ground rods shall be copper or copper-clad steel, 3/4-inch diameter by 10 feet long, listed for the purpose.

B. Plate electrodes shall be sized as noted on the plans, but not less than 2 feet round by 1/4-inch (6.35 mm) thick steel or iron. Where copper or bronze plates are used, thickness shall not be less than 1/16 inch (1.5875 mm).

C. Concrete-encased electrodes shall consist of bare copper conductor, in direct contact with the concrete foundation, sized as noted on the plans, but not less than #4 AWG solid copper.

D. Ground ring shall consist of bare tinned copper stranded conductor, sized as noted on the plans, but not less than #2 AWG. Minimum length shall be 20 feet.

E. Common Electrode System (CES) for multiple separately derived systems. The CES shall consist of a copper stranded conductor sized as noted on the plans, minimum #3/0 AWG.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. All panelboard cabinets, equipment, enclosures, and conduit systems shall be grounded securely in accordance with pertinent sections of the NEC, as amended by any local codes. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current-carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in the NEC. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.

B. Grounding of metal raceways shall be assured by means of grounding bushings on feeder conduit terminations at the service entrance, distribution switchboards, and panelboards, and by means of a continuous, stranded, copper grounding wire extended from the ground bus in the enclosure to the conduit grounding bushings.

C. A separate insulated grounding conductor, sized per the NEC, shall be installed in all electrical metallic tubing (EMT).

D. Ground cable basket/tray with #6CU AWG conductor between grounding electrode system and cable tray. Utilize listed grounding connectors. Route in conduit between grounding electrode system and first connection to cable basket/tray.

E. Rod, Pipe, and Plate Electrodes: Install per National Electrical Code (NEC) Article 250.53. Ground rods shall be installed full length, uncut. Top of ground rods shall be driven to a minimum of 2 inches below finished floor or grade and installed with lightweight polymer concrete inspection housings (test wells).

F. Concrete-Encased Electrodes: Install within the building foundation as described in NEC Article 250.52(A)(3).

G. Ground Rings: Install per NEC Article 250.52(A)(4) at a minimum of 5 feet from the building and a minimum of 30 inches below finished grade or 6 inches below the frost line where deeper.

H. Exterior direct-buried ground conductors shall be bare tinned copper at a minimum depth of 30 inches below finished grade or 6 inches below the frost line where deeper.

I. Equipment grounding conductor size shall be increased where feeder conductors are oversized for voltage drop in accordance with NEC 250.122(B).

J. Ground Busbars: Mount with a minimum of two standoff insulators.

K. Labeling: Label all ground bar connections as to the element grounded or bonded with non-metallic tags and attachments.

L. Ground conductors shall be exposed within electrical and MER/TR equipment rooms and installed in conduit elsewhere.

M. Where grounding and bonding conductors are installed in metallic conduit, each end of the raceway shall be bonded to the grounding conductors by means of listed bond bushings. Where bushings are not available for the conduit and cable size, listed pipe clamps may be used in lieu of bushings.

N. Use exothermic welds for all below grade connections except at test wells where mechanical connections shall be used.

O. All interior connections shall be mechanical or compression type.

P. All grounding conductors shall maintain a downward or horizontal direction where possible. Minimum bending radius of ground conductors shall be 8 inches.

Q. Do not encircle ground cables completely with magnetic metal (i.e., conduit straps, junction boxes, etc.). Use one-hole straps with nylon screws, fiberglass channel framing, or similar. Where encirclement cannot be avoided, provide a #6 AWG bond to the metal encirclement.

R. Connections of Dissimilar Metals: Coat surfaces with “NO-OX-ID-A” compound.

S. Air Plenums or Other Spaces used for Environmental Air: Insulated ground cables shall not be exposed within. Where routing or connections are required in such spaces, provide bare copper conductors.

3.2 GROUNDING AT THE SERVICE RATED EQUIPMENT

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses unless noted otherwise on the plans.

3.3 SPLICES

A. Where a splice is required, it shall be made with a UL Listed, irreversible compression-type connector or exothermic welding.

B. Exothermic welds shall be cast with size-appropriate molds as recommended by the thermal weld manufacturer.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections of the installed grounding systems.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer’s written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned drawings locating each test well, ground rod, and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location.

5. Report shall include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports. Reports shall include:

1. Name of equipment tested or locations in the system tested.

2. Test type and purpose.

3. Resultant test value(s).

4. Statement of pass or fail.

5. Test technician name, signature, and date for each report.

E. Report measured ground resistances.Excessive Ground Resistance: If resistance to ground exceeds IEEE Standard 142 recommendations, notify the Architect/Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 26 05 33

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install conduit and fittings as shown on the drawings and as specified herein.

1.2 COORDINATION

A. It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, ductwork, or structural steel supports shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines that pitch, large air ducts, and all structural steel shall be given priority.

B. Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the National Electrical Code (NEC). If, because of bends or elbows, a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

C. The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the project. When conduit becomes bent, holes are punched through same, or outlets are moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.

1.3 RELATED SECTIONS

A. Specification Section 26 05 53, Identification for Electrical Systems.

B. Specification Section 26 27 26, Wiring Devices.

1.4 ACTION SUBMITTAL

A. Submit product data indicating compliance with this specification for each type of box, conduit, raceway, fitting, wall and trench duct.

B. Exposed Conduit Routing: Where conduit must be exposed in finished areas, submit a routing diagram to the Architect for acceptance prior to installation. Submittal shall include sufficient detail to communicate the route vertically and horizontally with heights stated.

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit sizes for various numbers and sizes of wire shall be as required by NEC Chapter 9, but shall not be smaller than 3/4-inch size except as otherwise noted.

B. Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label for the specific product type.

C. All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized or cadmium plated. Individual hangers, trapeze hangers, and rods shall be prime-coated.

D. Calibrated pull string/measuring tape shall be Greenlee Part No. 435, or as accepted.

2.2 CONDUIT

A. Rigid galvanized steel (RGS), intermediate metallic conduit (IMC), and electrical metallic tubing (EMT):

1. Each type shall be UL listed to the current standard.

2. Acceptable Manufacturers: Allied Tube & Conduit, Republic Conduit, Western Tube & Conduit Corp., Wheatland Tube Company, or as accepted.

B. PVC-Coated RGS or IMC:

1. Minimum Exterior PVC Coating: 40 mils bonded to the exterior surface.

2. Minimum Interior Urethane Coating: 2 mils on both interior and steel threads.

3. Listed as UL 6 and compliant with ANSI C80.1 and NEMA RN 1.

4. Acceptable Manufacturers: Robroy Industries Plasti-Bond/KorKap/ Perma-Cote, Thomas and Betts Ocal, or as accepted.

C. Polyvinyl chloride (PVC) conduit shall be Cantex, Carlon, or as accepted.

D. Flexible metallic conduit (FMC):

1. Galvanized steel.

2. Listed as UL 1, UL 1479.

3. Wall thickness as noted in Part 3.

4. Acceptable manufacturers are: Atkore AFC Cable Systems, Southwire, Electri-Flex, Anaconda, or as accepted

E. Liquid-tight flexible metallic conduit (LFMC):

1. Listed as UL 360 and CSA C22.2 No. 56 requirements. The finished Type LFMC dimensions shall be in accordance with Table 5.1 of UL 360 and Table 2 of CSA C22.2 No. 56,

2. Galvanized steel with a sunlight resistant, flame retardant PVC jacket.

3. Product shall be available in a variety of sub configurations for specific environmental applications:

a. Low Smoke Zero Halogen Cable – Type LSZH.

b. Hi-Low Temperature.

c. Splash Zone in Food Production Areas - PVC jacket (white) does not promote the growth of bacteria, marked NSF 169 compliant.

d. Computer Blue with extended UL performance testing.

4. Acceptable manufacturers are: Atkore AFC Cable Systems, Southwire, Electri-Flex, Anaconda Sealtite, or as accepted.

F. Liquid-tight flexible non-metallic conduit (LFNC):

1. Listed as UL 1660 and CSA C22.2 No. 227.2.1. The wall thicknesses and dimensions of the layered conduit shall comply with Table1 of harmonized UL 1660/CSA C22.2 No. 227.2.1 of UL 1660.

2. Layered Type A construction, nylon reinforced braid between two layers. PVC shall be a Flame retardant, Sunlight resistant, Oil resistant, and Mild acid resistant compound.

3. Product shall be available in a variety of sub-configurations for specific environmental applications:

a. Splash Zone in Food Production Areas - PVC jacket (white) does not promote the growth of bacteria, marked NSF 169 compliant.

b. Orange PVC jacket.

4. Acceptable manufacturers are: Atkore AFC Cable Systems, Electri-Flex, or as accepted

G. Conduit systems shall be color coded. Reference Specification Section 26 05 53, Identification for Electrical Systems, for additional requirements.

2.3 FITTINGS

A. Couplings and connectors for RGS or IMC conduit shall be steel or malleable iron, threaded, and rain- and concrete-tight. Couplings and connectors that are exposed, installed in hollow construction, or above ceilings shall be threaded, unicouple, or compression type. Steel set-screw or compression-type fittings shall be used for interior EMT and metallic flex. Steel weathertight compression fittings shall be used for exterior EMT. Die-cast or pressure-cast EMT and metallic flex fittings shall NOT be allowed.

B. Liquid-tight metallic flex connectors shall be steel or malleable iron.

C. Bushings and locknuts shall be malleable iron with sharp, clean-cut threads.

D. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or as accepted.

E. Expansion joint fittings on RGS or IMC conduit shall be Crouse-Hinds Type XJ, or as accepted. Expansion joint fittings on PVC conduit shall be Carlon Type E945, or as accepted.

F. Entrance seals shall be O.Z. Type FSK, or as accepted.

G. Explosion-proof and temperature seals shall be listed for 40% fill application, vertical and horizontal, and shall be Appleton Type EY, or as accepted.

H. Couplings and connectors for PVC conduit shall be of the same manufacturer as the conduit to be coupled or connected. Fittings shall be provided in accordance with the manufacturer's recommendations.

2.4 SURFACE RACEWAY

A. Where devices are shown within the surface raceway, they shall meet the requirements of a "Multi Outlet Assembly" as described in Specification Section 26 27 26, Wiring Devices.

2.5 BOXES

A. All boxes must conform to the provisions of NEC Article 314. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Boxes shall not be less than 4 inches square and 1-1/2 inches deep unless otherwise noted.

B. Generally, boxes shall be hot-dipped galvanized steel with knockouts. Where recessed, boxes shall have square cut corners. Outlet, switch, and gang size junction boxes on exterior surfaces or in damp locations shall be corrosion-resistant, cast malleable iron. Boxes shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS or FD, Crouse-Hinds, or as accepted. Conduit bodies shall be corrosion-resistant, cast malleable iron, and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Bodies shall be Appleton Unilets, Crouse-Hinds, or as accepted.

C. Deep boxes shall be used in walls covered by wainscot acoustical wall panels or paneling and in walls of glazed tile, brick, or other masonry that will not be covered with plaster. The bottom of the box shall be located on the horizontal joint. Through-the-wall type boxes shall not be used unless specifically called for. All boxes shall be non-gangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

D. All light switches, receptacles, and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this Contract.

E. Pull and junction boxes shall be substantially-made code-gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle-iron framing where required. Boxes shall be 4 inches square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas, and shall be installed where required to pull cable or wire, but only in finished areas by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface-mounted boxes shall line up evenly with the edges of boxes. Covers for flush-mounted oversize boxes shall extend 3/4 inch past the box all around. Covers for 4-inch square and 4-inch ganged boxes shall extend 1/4 inch past the box all around.

F. Outlets are only approximately located on the plans and great care must be used in the actual location of outlets by consulting the various detailed drawings. Outlets shall be flush with finished wall or ceiling. Trim, cases, or other fixtures shall have their boxes installed symmetrically on such trim or fixture. Refer to the drawings for location and orientation of all outlet boxes.

G. Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Extension rings, where required, shall be installed so that the plaster ring is flush with the finished surface.

H. Exterior gang-type boxes shall be cast type. Where any box occurs within 12 inches of the earth, provide cast iron type.

I. Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

J. Construct pull boxes and rack space for future conduits equal to 25% of present runs. Provide required barriers. Attach a plastic label to each pull box cover listing the feeder numbers enclosed within and the source of current. Identify each conduit at pull box termination with voltage and feeder number in red. Provide sufficient cable slack at terminations and in junction and pull boxes to allow for cable contraction and for future splicing. Fireproof cable in pull boxes where more than one feeder is enclosed.

K. Boxes shall be as manufactured by Appleton, Raco, Steel City, or as accepted.

2.6 TV / MONITOR BOXES

A. Boxes must conform to the provisions of NEC Article 314. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Boxes shall be available in multi-gang configurations but not less than a 4" high x 2-1/2" wide x 2-1/2" deep power wiring compartment unless otherwise noted.

B. TV/Monitor boxes shall be recessed type with square cut corners. Boxes shall be corrosion-resistant hot-dipped galvanized steel with knockouts. Power and data side shall be separated by field-configurable voltage divider. Box shall include flanged regressed trim ring to permit the connection of plugs and cables to the devices contained within while remaining inside the wall surface plane. Boxes shall be Arlington Industries, Inc., FSR Inc., or as accepted.

PART 3 - EXECUTION

3.1 CONDUIT

A. Applications:

1. PVC conduit may be used for all exterior underground systems, in slab, below slab-on-grade, and in concrete or masonry walls. For medical applications, PVC conduit shall not be used to supply power to medical equipment or branch circuits in patient care areas, NO EXCEPTIONS.

a. All plastic conduit shall be rigid, Schedule 40, heavy wall PVC.

b. Install bell ends at all conduit terminations in manholes and pull boxes and under equipment.

c. All bends over 30 degrees shall be made with wrapped IMC.

d. Stubups below switchboard/switchgear equipment shall be between 1 and 2 inches above the floor surface with the bell fitting installed.

e. All plastic conduit, except that used for telephone, shall contain a code-sized bond wire.

2. IMC shall be used for all conduit larger than 2 inches, and for all underground or in-slab conduit, except where PVC is permitted or where RGS is specified. IMC conduit shall be used in explosion-proof areas.

3. RGS conduit shall be used in place of IMC or where it is specified on the plans.

4. PVC-coated RGS (PVC-RGS) conduit shall be used in corrosive areas where exposed to physical damage, or where specified on the plans.

5. Liquid-tight flexible metallic conduit, in lengths not exceeding 3 feet, shall be used to connect motors and transformers. Installation shall be such that considerable slack is realized. The conduit shall contain a separate grounding conductor.

6. Flexible metallic conduit shall be used in lengths not exceeding 6 feet. The conduit shall contain a separate grounding conductor. Connectors shall be steel or malleable iron.

   a. Reduced wall type shall be acceptable for connection of fire alarm, lighting fixtures, and wiring devices or equipment mounted in movable panels such as acoustical ceiling tiles, etc. Installation shall be such that considerable slack is realized. Factory supplied and listed lighting fixture whips are acceptable in lieu of flexible metallic conduit.

   b. Full wall type shall be used for flexible connections in any area subject to physical damage.

7. Liquid-tight Flexible Metallic Conduit:

   a. Food service areas requiring flexible connections - Splash zone, white NSF 169 compliant.

   b. Healthcare Central Sterile, Lab, Pharmacies, and for imaging suites and Operating Rooms requiring flexible connections - Splash zone, white NSF 169 compliant.

   c. Below computer floors - Computer Blue with extended UL performance testing.

   d. Air plenums containing flexible connections - Low Smoke Zero Halogen Cable – Type LSZH.

   e. Hi-Low temperature spaces, like cooler and freezers, requiring flexible connections – for Hi (up to 60˚C wet/105˚C dry) or Low temperature (down to -55˚C) applications.

8. Liquid-tight Flexible Non-metallic Conduit (LFNC)

   a. Use only where specifically called out on the plans, sub-configurations as described.

9. All other conduit shall be EMT. A separate insulated grounding conductor, sized per the NEC, shall be installed in EMT.

B. Conduit shall be continuous from outlet to outlet, cabinet, or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.

C. All conduit shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, and electrical closets, and where indicated on the drawings. No conduit shall be run exposed in finished areas without specific acceptance by the Architect.

D. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other pipe.

E. Where possible, all conduit for wiring within stud or moveable partitions shall enter the partition from above.

F. Provide sleeves and chases where conduit passes through floors or walls as part of the work of this section. Core drilling will only be permitted where accepted by the Architect.

G. Conduit stubbed up/down or through floor slabs shall be wrapped RGS or wrapped IMC with a minimum of 6 inches of conduit exposed out of slab for connection of threaded or compression fitting. Where conduit bends extend out of slab, the conduit shall be placed at the maximum allowable distance from the exit surface and shall have a bend radius as allowed by code to provide as true and square a conduit exit as possible. Conduit deck flanges will be used where conditions allow and where the flange can be tightly secured flush to the face of a concrete form.

    1. Exception: Conduit stubbed through slabs on grade into the bottom of full height switchboard/switchgear sections, floor mounted full height UPS sections, floor mounted full height automatic transfer switches, floor mount transformers and load banks.

H. Openings through fire-rated floors and fire walls through which conduit passes shall be sealed by fire stop material to seal off cold smoke and toxic fumes. Fire-seal material shall have an hourly fire rating equal to or higher than the fire rating of the floor or wall through which the cable or conduit passes. Material used shall conform to the Authority Having Jurisdiction (AHJ) requirements. Openings through smoke walls through which cable or conduit passes shall be sealed with non-shrink, non-combustible material approved by the AHJ to seal off cold smoke and toxic fumes.

I. Conduit above lay-in grid-type ceilings shall be installed in such a manner that it does not interfere with the “lift-out” feature of the ceiling system.

J. Conduit runs shall be installed to maintain the following minimum spacing wherever practical:

    1. Water and Waste Piping: Not less than 3 inches.

    2. Steam and Condensate Lines: Not less than 12 inches.

    3. Radiation and Reheat Lines: Not less than 6 inches.

K. All underground conduit outside of any buildings shall be a minimum of 24 inches below finished grade, except where noted otherwise on the drawings.

L. All underground feeder conduit (this does not include branch circuits) outside of any buildings shall be concrete encased. Concrete shall be 3/8-inch aggregate with a nominal compressive strength of 2,500 PSI. It shall have enough slump to flow to the bottom of the duct formation and not so wet as to cause the ducts to float. Each conduit shall be completely encased in concrete not less than 3 inches all around. Concrete shall not be poured until conduit has been inspected by the Architect. Separators or spacing blocks shall be made of plastic or other suitable non-metallic, non-decaying material placed on not greater than 5-foot centers. Ducts shall be anchored to prevent movement during placement of concrete.

M. Provide corrosion protection for metallic conduit under concrete or in earth. Provide half-lap wrap of polyethylene 20-mil tape, factory PVC coating, or as accepted. Where PVC coating is provided, joints must be sealed in accordance with the coating manufacturer's published instructions.

N. PVC-coated RGS (PVC-RGS) joints must be sealed in accordance with the coating manufacturer's published instructions. Installer shall be certified by the manufacturer and shall provide a valid, unexpired "Certified Installer" card prior to installing materials. Product manufacturer shall perform an inspection of the installed product and issue an acceptance report of the installation.

O. Each empty conduit shall be provided with an installed nylon pull string.

P. Each medical equipment conduit shall be provided with an installed calibrated pull string/measuring tape.

Q. Bending: Changes in direction shall be made by bends in the conduit wherever possible, and these bends shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, but in no case less than shown in the NEC.

R. Not more than four 90-degree bends will be allowed in one raceway run. Where more bends are necessary, a pull box shall be installed. All bends in 1-inch and smaller conduit shall be made with a conduit bender, and all larger conduit sizes shall have machine bends.

S. Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic coupling fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Transition from plastic to steel conduit shall be with PVC female threaded adaptors.

T. Plastic conduit shall be stored on a flat surface and protected from the direct rays of the sun.

U. The ends of all conduit shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduit. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.

3.2 FITTINGS

A. Bushings and Locknuts: Where conduit enters boxes, panels, cabinets, etc., it shall be rigidly clamped to the box by locknuts on the outside and inside, and a bushing on the inside of the box. All conduit shall enter the box squarely.

B. Provide insulated bushings per the NEC on all conduit. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.

C. Provide expansion fittings for all conduit where it crosses building expansion joints, not to exceed 100 feet apart in straight runs. Fittings shall be complete with bonding jumpers and clamps and shall be suitably bonded to conduit.

D. Provide weatherproof fittings in exterior installations or as noted on the plans.

3.3 SUPPORTS

A. All raceways that are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation.

B. Conduit shall be supported at intervals required by the NEC, straight runs, at any bend, and at every outlet, junction box, panel, etc. This shall apply to vertical runs as well as horizontal runs. Where conduit is run individually, it shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are suspended from the ceiling, or above ceiling, they shall be supported by hanger rods and hangers. Conduit installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduit. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel, 3/8-inch diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.

3.4 GENERAL

A. Install all boxes parallel and perpendicular to the finished floor. Adjust all flush mounting positions to compensate for wall material thickness. Where devices occur in the same horizontal viewing plane, align devices.

B. Where outlet boxes occur on opposite sides of a common wall, do not place back-to-back or use through-the-wall boxes, to limit sound transmission between rooms.

C. Where fire-rated walls occur, all membrane penetrations shall comply with the International Building Code (IBC) for walls/partitions, and for floor-ceilings/roof-ceilings. Outlet boxes in rated walls shall be steel. Outlet boxes on opposite sides of a rated wall shall be separated by a minimum of 24 inches horizontally.

D. Support all boxes independently of conduit, except cast type which may be supported by rigid steel conduit only. Secure flush-mount boxes to wall and interior partition studs using stamped steel bridges as required to accurately position boxes. Secure ceiling-hung boxes to adjustable steel channel fasteners.

E. All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. All recessed wall- and ceiling-mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on the surface of drywall or plaster shall be secured to wall or ceiling with fasteners rated for the weight to be supported, minimum 50 lbs. per fastener.

F. Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

G. Where emergency power and normal power are located in the same outlet box or a potential of 480 volts is present in a switch box, install partition barriers to separate the various systems.

3.5 TV / MONITOR BOXES

A. Install boxes level, parallel, and perpendicular to the finished floor and walls, respectively. Adjust all finish trims tight to the respective wall finish material.

B. Integrate adjacent low-voltage devices serving TV/monitor equipment within the common box. Adjust box size to accommodate both line-voltage and low-voltage devices. Provide appropriate activation plates and compartment barriers.

C. Coordinate mounting height with architectural elevations and adjust to permit the installation of TV/monitor mounting brackets. Box shall remain behind the silhouette of the TV/monitor equipment.

3.6 SEPARATE CONDUIT SYSTEMS

A. Each system shall be contained in a separate conduit system. This includes each power system, lighting system, signal system of whatever nature, telephone, emergency system, emergency subsystems, sound system, control system, fire alarm system, etc.

B. Each item of building equipment shall have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, but separate conduits shall be used for larger size feeders.

3.7 ROUTING AND EXPOSURE

A. Where conduit and boxes must be exposed, submit a sketch of the proposed route to the Architect for approval prior to installation.

B. Where conduit is exposed to exterior ambient temperatures for more than 10% of its length or 10 feet, whichever is less, increase the conductor sizes in accordance with the application of ambient temperature factors contained in NEC Table 310.15.

C. Conduit shall be installed at depths compliant with NEC Table 300.5.

END OF SECTION

Edition: _L-2207

SECTION 26 05 43

UNDERGROUND DUCTS & RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and Install Underground Utility Structures: Duct banks, manholes, vaults, handholes, and pull boxes as shown on the drawings and specified herein.

1.2 REFERENCED STANDARDS

A. AASHTO HB 17 - Standard Specifications for Highway Bridges.

B. ANSI C2 - National Electrical Safety Code.

C. ASTM A48/A48M - Specification for Gray Iron Castings.

D. ASTM C270 - Specification for Mortar for Unit Masonry.

E. ASTM C387 - Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

F. ASTM C858 - Specification for Underground Precast Concrete Utility Structures.

G. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.

H. ASTM C1037 - Practice for Inspection of Underground Precast Concrete Utility Structures.

I. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

J. ISO 9000 - Quality Management.

K. ISO 10012 - Measurement Management Systems.

L. NFPA 70 - National Electrical Code.

M. SCTE 77 - Specification for Underground Enclosure Integrity.

1.3 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as components of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.

2. Multiple duct banks.

D. Manhole: A subsurface enclosure that personnel may enter, used for the purpose of installing, operating, and maintaining submersible equipment and cable.

E. Vault: A structurally solid enclosure, including all sides, top, and bottom, below ground where entry is limited to personnel qualified to install, maintain, operate, or inspect the enclosed equipment or cable. The enclosure may have openings for ventilation, personnel access, cable entrance, and other openings required for operation of equipment in the vault.

F. Handhole: An access opening, provided in a below-the-surface enclosure in connection with underground lines, into which personnel reach but do not enter, for the purpose of installing, operating, or maintaining equipment or cable or both.

G. Pull Box: Same as a handhole. May or may not have a bottom.

1.4 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's cut sheet for each type of underground utility structure specified. Data shall include box and lid weight rating, lid text legend, accessories provided, and manufacturer's installation recommendations. Provide SCTE 77 Tier Rating test documentation or AASHTO H20 Rating test documentation, as required.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.

b. Include duct entry provisions, including locations and duct sizes.

c. Include reinforcement details.

d. Include frame and cover design and manhole chimneys.

e. Include ladder details.

f. Include grounding details.

g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

h. Include joint details.

2. Factory-Fabricated Vaults, Handholes, and Boxes other than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.

b. Include duct entry provisions, including locations and duct sizes.

c. Include cover design.

d. Include grounding details.

e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

3. Duct Banks: Include sketch section through each assembly configuration, complete with dimensions, reinforcement bar sizes (if specified), fill material type(s), separator callouts, and marker tape position.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store precast concrete and other factory-fabricated underground utility structures at the project site as recommended by the manufacturer to prevent physical damage. Arrange so identification markings are visible.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Provide as specified in Specification Section 26 05 33, Raceway & Boxes for Electrical Systems.

2.2 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which it is used and selected to provide the minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.

b. CANTEX INC.

c. Carlon; a brand of Thomas & Betts Corporation.

d. PenCell Plastics.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Specification Section 26 05 53, Identification for Electrical Systems.

2.3 PRECAST CONCRETE VAULTS, HANDHOLES, AND BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. J&R Concrete Products Inc.

2. Jensen Precast.

3. Oldcastle Enclosure Solutions, “Christy.”

B. Comply with Standards:

1. AASHTO HB-17.

2. ASTM C858 for design and manufacturing processes.

C. Structural Load Ratings: As specified in Part 3, Underground Enclosure Application.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of the vault, handhole, or box.

1. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

2. Cover Hinges: Concealed, with hold-open ratchet assembly and spring assist mechanism.

3. Cover Handle: Recessed.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering or metallic nameplate with a permanent inscription indicating box contents, “ELECTRIC” “HIGH VOLTAGE” “COMM/DATA” as indicated for each service.

6. Configuration: Units shall be designed for flush burial with closed bottom. Units with clear inside dimensions of 24" wide x 36" long or less shall be open bottom unless otherwise indicated on the drawings.

7. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

a. Extension shall provide increased depth required.

b. Slab: Same dimensions as bottom of enclosure, arranged to provide closure.

8. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

9. Windows (Knockout Panels): Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional space vertically and horizontally to accommodate alignment variations.

   a. Locate no less than 6 inches from interior surfaces of walls, floors, or frames and covers of vaults or handholes, but close enough to corners to facilitate cable racking on walls.

   b. Cast-in-place with welded wire fabric reinforcement for field cutting and bending to tie-in to concrete envelopes of duct banks.

   c. Openings must be framed with at least two additional No. 4 steel reinforcing bars in concrete around each.

10. Duct Entrances in Vault or Handhole Walls:

   a. Type and Size: Fittings matched to duct or conduit to be terminated.

   b. Fittings: Aligned with elevations of approaching ducts and located near interior corners of vaults or handholes to facilitate cable racking where required.

11. Vaults or handholes 30" wide x 48" long (300 mm wide x 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

A. General Description:

1. Standard: Comply with SCTE 77.

2. Structural Load Ratings: As specified in Part 3, Underground Enclosure Application.

3. Configuration: Units shall be designed for flush burial with closed bottom. Units with clear inside dimensions of 24" wide x 36" long or less shall be open bottom unless otherwise indicated.

4. Cover: Weatherproof, secured by stainless steel tamper-resistant penta head bolts and having structural load rating consistent with enclosure. Provide two-piece split cover where length is 36 inches or greater.

5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

B. Cover Legend: Molded lettering, “ELECTRIC””COMM/DATA” as indicated for each service.

C. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

D. Handholes 36" wide x 60" long (914 mm wide x 1,524 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

E. Polymer Concrete Handholes and Pull Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.

b. NewBasis.

c. Oldcastle Enclosure Solutions, “Christy.”

d. Quazite: Hubbell Power Systems, Inc.

e. The product indicated on the drawings.

F. PRECAST MANHOLES

G. General Description:

1. One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

2. Comply with ASTM C858.

3. Structural Design Loading: Comply with requirements in Part 3, Underground Enclosure Application.

4. Windows (Knockout Panels): Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional space vertically and horizontally to accommodate alignment variations.

5. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

6. Cable Racking: Provide racking on all four walls.

7. Ground Rod Sleeve: Provide a 3-inch (75-mm) diameter PVC sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the duct entering the structure.

8. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Christy Concrete Products.

2. Jensen Precast.

3. Oldcastle Precast Group.

4. Olson Precast Company.

5. Utility Vault Co.

2.5 UTILITY STRUCTURE ACCESSORIES

A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 30B with milled cover-to-frame bearing surfaces; diameter 29 inches (725 mm) or as indicated on the drawings.

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

2. Cover Legend: Cast in. Selected to suit system.

a. Legend:

1) “ELECTRIC-LV” for duct systems with power wires and cables for systems operating at 600 volts and less.

2) “ELECTRIC-HV” for duct systems with medium-voltage cables.

3) “SIGNAL” for communications, data, and telephone duct systems.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu.ft. (60 L) where packaged mix complying with ASTM C387, Type M, may be used.

b. Seal joints watertight using preformed plastic or rubber complying with ASTM C990. Install sealing material according to sealant manufacturer’s written instructions.

C. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch (50-mm) - diameter eye, and 1" x 4" (25-mm x 100-mm) bolt.

1. Working Load Embedded in 6-inch (150-mm), 4,000-psi (27.6-MPa) Concrete: 13,000-lbf. (58-kN) minimum tension.

E. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch (31-mm) - diameter eye, rated 2,500-lbf. (11-kN) minimum tension.

F. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch (22-mm) -diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf. (180-kN) shear and 60,000-lbf. (270-kN) tension.

G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2" (13-mm) ID x 2-3/4" (69-mm) deep, flared to 1-1/4 inches (31 mm) minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf. (53 kN) minimum.

H. Ground Rod Sleeve: 3-inch (75-mm) PVC sleeve in manhole, vaults, and handholes floors. Locate 2 inches (50 mm) from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36" (900 mm) high x 4" (100 mm) wide, with provisions to connect to other sections to form a continuous unit, with a minimum of nine holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches (75 mm) with 450-lb. (204-kg) minimum capacity to 20 inches (500 mm) with 250-lb. (114-kg) minimum capacity. Top of arm shall be nominally 4 inches (100 mm) wide, and arm shall have slots along full length for cable ties.

J. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35°F (2°C). Capable of withstanding temperature of 300°F (150°C) without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

K. Fixed Manhole Ladders: UL-listed, heavy-duty fiberglass, arranged for attachment to wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.

L. Cover Hooks: Heavy duty, designed for lifts 60 lbf. (270 N) and greater; two required.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by the manufacturer.

3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST Standards.

PART 3 - EXECUTION

3.1 UNDERGROUND ENCLOSURE APPLICATION

A. Vaults, Handholes, and Pull Boxes for 600 Volts and Less:

1. Units in Roadways, Drives, Parking Areas, and Other Deliberate Traffic Paths: Precast concrete. AASHTO H-20 structural load rating.

2. Units in Parking Lot Islands or Medians, in Sidewalk and Similar Applications With a Safety Factor for Occasional, Nondeliberate Loading by Vehicles: Precast or polymer concrete, fiberglass-reinforced polyester resin, and high-density plastic enclosures, SCTE 77, Tier 15 structural load rating.

3. Units Subject to Light-Duty Pedestrian Traffic Only:

a. Sidewalk and Similar Applications with NO Anticipated Nondeliberate Vehicular Traffic: Precast or polymer concrete, fiberglass-reinforced polyester resin, and high-density plastic enclosures, SCTE 77, Tier 5 structural load rating.

4. Cover design load shall not exceed the design load of the vault or handhole or box.

B. Vaults, Handholes, and Pull Boxes for Medium Voltage:

1. Units in Roadways, Drives, Parking Areas, and Other Deliberate Traffic Paths: Precast concrete. AASHTO H-20 structural load rating.

2. Units Occurring Outside of Roadways, Drives, Parking Areas, and Other Deliberate Traffic Paths: Precast concrete or polymer concrete. SCTE 77, Tier 22 structural load rating.

C. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

3.2 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, vaults, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify the Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct bank entrances into manholes, vaults, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes, vaults, and handholes, and as approved by the Architect.

3.3 MANHOLE, VAULT, HANDHOLE, AND PULL BOX INSTALLATION

A. Install manholes, vaults, handholes, and pull boxes in accordance with the unit manufacturer's recommendations.

B. Lift and support precast concrete units only at designated lifting or supporting points.

C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to the same density as adjacent undisturbed earth.

D. Install manholes, vaults, handholes, and pull boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by the manufacturer.

E. Elevation of Handholes and Pull Boxes: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade. Top edge of each box shall set above any low points to prevent unintended liquid (water) entry. Raise each box accordingly and coordinate with the General Contractor to slope paving away from the top edge of box. Provide adjustment rings as required.

F. Install with bottom below frost line, below grade.

G. Drainage:

1. Install drains in bottom of manholes, vaults, and handholes where indicated. Coordinate with drainage provisions indicated.

2. Provide drainage pit containing pea gravel below. Pit shall be sized at 25% of the box interior volume or detailed on the drawings, minimum 6-inch diameter, 24-inches deep.

H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

I. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

J. Field-Installed Bolting Anchors in Concrete Manholes, Vaults, and Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

K. Conduit vertical risers shall be galvanized RMC with corrosion protection applied.

3.4 PRECAST CONCRETE MANHOLE, VAULT, AND HANDHOLE INSTALLATION

A. Comply with ASTM C891 unless otherwise indicated.

B. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

C. Where detailed, cast handhole cover frame integrally with handhole structure.

D. Ground underground ducts and utility structures according to Specification Section 26 05 26, Grounding & Bonding of Electrical Equipment.

E. Provide a ground rod within each manhole, vault, or handhole when:

1. The unit contains MV feeders.

2. The unit contains conductor sets with parallel runs.

3. Specified on plans.

F. Non-current-carrying metallic components shall be bonded to the equipment ground conductor(s) contained in the manhole, vault, or handhole. Match equipment conductor size, 6 AWG copper minimum. Install a listed ground lug on each metallic component. Where a metallic lid is provided, install a 6-foot-long stranded ground conductor from the lid to the equipment ground conductor.

G. Metallic conduits entering a handhole or pull box shall be bonded to the equipment ground conductor(s) contained in the handhole or pull box.

H. Where ground rods are present within the manhole, vault, or handhole, non-current-carrying metallic components and equipment grounds shall be bonded to the ground rod(s) with minimum 6 AWG copper wire.

3.5 EARTHWORK

A. Excavation and Backfill: Follow requirements in Specification Section 26 05 00, General Provisions.

3.6 DUCT AND DUCT BANK INSTALLATION

A. Where indicated on the drawings, install duct, spacers, and accessories into the duct bank configuration shown. Duct installation requirements in this section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes, vaults, and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1,200 mm), both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have a maximum of three 90-degree bends or the total of all bends shall be no more than 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in the same plane.

F. End Bell Entrances to Manholes, Vaults, and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.

G. Building Wall Penetrations: Make a transition from underground duct to galvanized RMC at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-galvanized RMC transition. Install galvanized RMC penetrations of building walls as specified in Specification Section 26 05 44, Sleeves & Sleeve Seals for Electrical Raceways and Cabling.

H. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

I. Pulling Cord: Install 200-lbf. (1000-N) -test nylon cord with calibrated markers in empty ducts.

J. Duct banks occurring outside the building footprint and routing under roadways, drives, parking areas, and other deliberate traffic paths shall be concrete encased.

K. Ducts and duct banks occurring inside the building footprint and under drives, parking areas, and other deliberate traffic paths shall be concrete encased.

L. Concrete-Encased Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Provide trench width as required in Specification Section 26 05 00, General Provisions.

2. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade unless otherwise indicated. Set elevation of top of duct bank below frost line.

3. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

4. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

5. Minimum Space between Duct: 3 inches (75 mm) between edge of duct and exterior envelope wall, 3 inches (75 mm) between ducts for like services, and 12 inches (300 mm) between power and communications ducts.

6. Elbows: Install manufactured galvanized RMC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

7. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

9. Concrete Strength: Provide concrete mix strength of 3,000 psi at 28 days or as required by Division 03.

10. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover on the duct bank and 12 inches (300 mm) between power and communications ducts.

11. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

12. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in the middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

13. Backfill as described in Specification Section 26 05 00, General Provisions.

M. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Provide trench width as required in Specification Section 26 05 00, General Provisions.

2. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.

3. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade unless otherwise indicated. Set elevation of top of duct bank below frost line.

4. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

6. Install duct with a minimum of 3 inches (75 mm) between ducts for like services and 12 inches (300 mm) between power and communications duct.

7. Elbows: Install manufactured galvanized RMC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

8. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Division 31 for installation of backfill materials.

    a. Place a minimum of 3 inches (75 mm) of sand as a bed for duct. Place sand to a minimum of 6 inches (150 mm) above top level of duct.

    b. Underground-Line Warning Tape: Bury conducting underground line specified in Specification Section 26 05 53, Identification for Electrical Systems, no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.7 FIELD QUALITY CONTROL

A. Perform the Following Tests and Inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch (300-mm) -long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.

3. Test manhole, vault, and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Specification Section 26 05 26, Grounding & Bonding of Electrical Equipment.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, vaults, and handholes, including sump.

1. Sweep floor, removing dirt and debris.

2. Remove foreign material.

END OF SECTION

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SECTION 26 05 44

SLEEVES & SLEEVE SEALS FOR ELECTRICAL RACEWAYS & CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install raceway sealing systems, sleeves, and related weatherproofing as specified herein.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Sheet Metal Sleeves, Galvanized Steel, Round: Galvanized-steel sheet; thickness not less than 24 gauge (0.6 mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Existing Construction - Wall Sleeves: Fabricate non-flanged pipe sleeves from standard Schedule 40 conduit cut flush at both sides of wall.

2.2 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1,270 mm) and with no side larger than 16 inches (400 mm), thickness must be 17 gauge (1.3 mm).

b. For sleeve cross-section rectangle perimeter not less than 50 inches (1,270 mm) or with one or more sides larger than 16 inches (400 mm), thickness must be 10 gauge (3.5 mm).

2.3 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Fiber-reinforced plastic or stainless steel.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

2. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.5 POURABLE SEALANTS

A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.6 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.

b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.

2. Interior Penetrations of Non-Fire-Rated Floors:

   a. Seal space outside of sleeves with pourable sealants. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.

   b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.

3. Use round sleeves unless penetration arrangement requires rectangular sleeved opening.

4. Size pipe sleeves to provide adequate annular clear space, 1/4-inch minimum, between sleeve and raceway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.

5. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

6. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. New Construction: Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeves during construction of floor or wall.

2. Existing Construction with Cored Openings: Install steel pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install watertight sleeve seal systems in sleeves in exterior concrete walls (above and below grade) and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

C. Review the project soils report for notations regarding presence of hydrocarbons. Where present, provide Nitrile (Buna N) link and gasket material.

END OF SECTION

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SECTION 26 05 48

VIBRATION CONTROLS & ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for vibration controls and anchors for electrical systems, including but not limited to:

1. Support wires for fixtures and devices mounted in acoustical lay-in ceilings.

2. Transformer vibration isolation.

3. General spring isolation.

4. Equipment anchoring.

B. Related sections include the following:

1. Specification Sections under 09 51 00, Acoustical Ceilings.

2. Specification Sections under 26 22 00, Low-Voltage Transformers.

3. Specification Sections under 26 24 00, Switchboards & Panelboards.

4. Specification Sections under 26 32 00, Packaged Generator Assemblies.

5. Specification Sections under 26 51 00, Interior Lighting

6. Specification Sections under 26 56 00, Exterior Lighting.

1.2 ACTION SUBMITTALS

A. Submit product data indicating compliance with this specification for each type of support product to be used. Provide additional supporting information as follows:

1. Transformer support details where mounting above floor slab.

2. Anchoring devices for generator and transformers.

3. Anchoring devices for switchboards, panelboards, and transfer switches.

1.3 REFERENCE PUBLICATIONS

A. ACI: American Concrete Institute.

B. ASTM: American Society for Testing and Materials.

C. IBC: International Building Code.

D. ICC-ES: International Code Council Evaluation Service.

E. NEC: National Electrical Code - NFPA 70.

F. SEI: Structural Engineering Institute.

1.4 COORDINATION

A. Coordinate installation of inserts in concrete decks with affected trades.

PART 2 - PRODUCTS

2.1 TRANSFORMER ISOLATION PADS

A. Rubber Isolation Pads: CalDyn, Mason, or equal.

B. Cork Reinforced Isolation Pads: CalDyn, Mason, or equal.

2.2 ANCHOR COMPONENTS

A. Concrete Inserts: Powers, Tolco, Tomarco, or equal.

B. Metal Framing Channel: B-Line, Unistrut , or equal.

C. Expansion Anchors and Quick Bolts: Hilti, Powers, Remset, or equal.

D. Beam Attachments: Mason, Tolco, or equal.

E. Attachment Components: Mason, Tolco, or equal.

2.3 POST INSTALLATION ANCHORS

A. Post installed anchors shall be listed in a current evaluation report, issued by an evaluation agency:

1. International Code Council Evaluation Service (ICC-ES), or as accepted.

B. The compressive strength of the material in which the anchor will be installed shall meet or exceed the compressive strength of the material in which the anchor was tested.

2.4 SUPPORT WIRES

A. Description: “Galvanized soft annealed mild steel wires,” as defined in ASTM A641 (Class 1 Coating), is the wire referred to in this section.

B. Diameter of Wire: #10 wire is 0.135 inches in diameter and #12 wire is 0.106 inches in diameter, as shown by the U.S. Steel Wire Gauge.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Refer to specific equipment or component specification section for more installation requirements.

3.2 SUPPORT WIRES

A. Allowable load for support wires shall be:

Wire Size	Basic Load
#10 wire	343 lbs.
#12 wire	209 lbs.

B. Values are for tension only.

C. Twists on wire to develop the maximum allowable load:

1. Use a minimum of four twists within 1-1/2 inches. Three twists may be used to develop not more than one-half of the above values.

3.3 FIXTURES

A. Use flexible connection for all lighting fixture and ceiling devices mounted in acoustical lay-in ceilings. Acceptable methods are as follows:

1. Factory-supplied 3/8-inch by 6-foot-long whips for lay-in light fixtures (12 feet for master-slave extension whips).

2. 1/2-inch flex with field-installed conductors.

3. MC cable as permitted elsewhere in Division 26 of this specification.

4. Do not allow cables or flex conduits to rest on ceiling tiles.

B. Lighting fixture or ceiling device weighing up to 56 lbs. may be supported from the lay-in ceiling support system with additional requirements as follows:

1. Attach two #12 AWG slack safety wires from the structure to opposite corners of lay-in fixtures. Coordinate any deviations from the contract reflected ceiling plan with wire installer.

2. Install lighting-fixture-manufacturer-supplied clips or screws at the two short sides of 2' x 4' lay-in lighting fixtures, two per side.

3. Install lighting-fixture-manufacturer-supplied clips at sides of 4' x 4' lay-in lighting fixtures, two per side.

4. Install lighting-fixture-manufacturer-supplied bar hangers across 2-foot dimension of the lay-in grid. Attach each end to the grid as recommended for support application by the fixture manufacturer. Coordinate any deviations from the contract reflected ceiling plan with wire installer.

C. Independently support any lighting fixture or ceiling device weighing more than 56 lbs. from the ceiling support system to the structure.

3.4 LIGHTWEIGHT MISCELLANEOUS DEVICES

A. All lightweight miscellaneous devices, such as strobe lights, speakers, etc., shall be attached to the ceiling grid.

3.5 TRANSFORMER VIBRATION ISOLATION

A. Transformers are to have internal vibration isolation from the metal housing to the core of the transformer.

B. Use rubber isolation pads type CalDyn, Mason, or equal, for transformer housing isolation from the concrete structure.

C. Use rubber isolation pads type CalDyn, Mason, or equal, for transformer housing isolation from the metal framing channel supports structure. Provide combo nut washer, B-Line NW series. Washer face to mate to isolator at transformer mount point.

D. Use flexible metal conduit or rubber isolated gutters for final raceway connections to transformers where conduits are not brought up through the slab under the transformer. Install rubber wire guard on all edges of the gutter cut out to allow for conductor entrance in the transformer, panel, or switchgear.

E. When stubbing up underground or through slabs for connections to transformers, cut out metal grating under transformers to allow for conduit entrances under the transformer. Install bell adapters prior to installation of conductors. Where metal conduits enter from the bottom through the metal grating, isolate the metal from the conduit and use bond bushings to protect the cable and to bond the conduit to the transformer. Add additional grating as needed to prevent rodent intrusion into the transformer. Gratings are to be installed in a workmanlike manner and are to be painted to match the transformer factory color.

3.6 GENERATOR VIBRATION ISOLATION

A. Refer to specification on generator installation for requirements for vibration isolation. Include spring isolators as part of the generator submittal package.

B. Coordinate location of rebar in the generator concrete pads prior to pouring of pads to allow for proper location and depth of wedge anchor after the setting of the generator.

C. Use flex conduit and stranded wire for all connections to the generator.

D. Avoid connection of rigid conduit to the generator. Stub up from underground into the space below the output breaker termination location and at locations of control connections. When piping is required overhead, use metal flex for the last 18 to 36 inches as required. Avoid the use of liquid-tight flex as it is limited in deflection capabilities. Exterior flex conduit shall be liquid tight.

E. Use bare copper not installed in conduit for the grounding electrode conductor or from any ground loop indicated on the contract drawings.

F. Tighten the isolation springs on the generator according to the anchor manufacturer’s instructions.

3.7 POST INSTALLATION ANCHORS

A. Expansion-Type Anchors: Expansion-type anchors may be used, provided the allowable shear and tension loads are determined by test in accordance with the following:

1. The allowable values listed in an ICC-ES Evaluation Service Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC01, latest revision. Strength design values may be used, provided the anchors have been tested in accordance with AC193, latest revision. For anchors installed in the underside of a beam/slab, the allowable tension load design values should be based on the tabulated value for the anchors installed without special inspection.

B. Epoxy-Type Anchors: Epoxy-type (adhesive) anchors include anchors that rely on organic and inorganic compounds (include epoxies, polyurethanes, methacrylates, and vinyl esters) to develop the bond to the concrete. The use of shallow epoxy-type (adhesive) anchors are those with an embedment-to-diameter ratio less than 8. Epoxy-type (adhesive) anchors shall only be installed in conditioned, interior spaces. Exception: Where epoxy-type anchors are used as shear dowels at the perimeter of an existing opening (slab or wall) to be filled with concrete, or are being used to connect new concrete elements to existing concrete elements (e.g., gunite), they may be installed in exterior locations with prior approval of the project Structural Engineer. The design shear and tension capacities of epoxy-type anchors must be determined in accordance with the following:

1. The allowable loads may be based on the values listed in an ICC-ES Report that complies with the requirements of AC58 for a specific anchor in the same configuration tested.

2. Where epoxy-type (adhesive) anchors are used for structural applications, such as dowels between new and existing concrete, the anchors shall be installed in a manner such that the ultimate tensile capacity is controlled by the ultimate strength of the steel element. Exception: Epoxy-type (adhesive) anchors which cannot develop the tensile capacity of the steel element may be used to transfer shear forces only, provided that the loads on the anchor are amplified by a factor of 4.0. When epoxy-type (adhesive) anchors are used to resist tensile forces in structural applications, the minimum depth of embedment shall be greater than or equal to the development length (L_d), determined for a cast-in-place reinforcing bar of the same diameter and grade when considering a tensile splitting failure mode. Where tensile splitting need not be considered, the depth of embedment may be determined in accordance with Appendix D of ACI 318-02, as amended by Section 3.3 of AC 308.

C. Screw Anchors: The fastener is produced from hardened steel with threads, similar in appearance to a lag bolt. Screw anchors may be used, provided the allowable shear and tension loads are determined in accordance with the following:

1. The allowable values listed in the ICC-ES Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC106, latest revision, including the seismic qualification tests of AC106, Section 4.6.

2. Welding to these anchors is not permitted.

3. Screw anchors may be used to attach components, such as equipment, mechanical vibration isolators, or snubbers, to structural (reinforced) concrete, or for sill bolting applications.

4. The use of screw anchors is not permitted in overhead applications or for discrete hold-down forces, such as shear walls.

D. Power-Actuated Fasteners: Power-actuated fasteners (shot pins) may be used for limited applications, provided the allowable shear and tension loads are determined in accordance with the following:

1. The allowable values listed in an ICC-ES Evaluation Service Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC70, latest revision.

3.8 ANCHORS

A. Embedment, Spacing and Edge Distance: All anchors shall meet the minimum embedment, spacing, edge distance, and slab thickness criteria established by the relevant ICC-ES Report.

1. Unless otherwise noted in the report, the edge distance should be a minimum of 10 bolt diameters from the free edge of the slab and center-to-center spacing should be a minimum of 12 bolt diameters. If the edge distance is less than 10 diameters, and the load is directed toward the free edge, the allowable shear load should be reduced.

3.9 EQUIPMENT ANCHORING

A. Anchor equipment per switchgear manufacturer's instructions.

B. Install anchors with the proper depth per manufacturer's instructions for the specific anchor.

C. If edge of pad distance is not achievable, drill through the pad into the concrete floor below the pad.

D. Move anchor location farther away from the edge of the pad as required and add clips to the anchors to secure the rail of the switchgear where there are not convenient holes to anchor through.

E. Multi-section equipment shall be bolted together to form a single unit. Attachment shall be in conformance with the equipment manufacturer's recommendations for such equipment. No deviations will be accepted.

F. Flush-Mounted Panelboards: Shall be anchored between wall studs, minimum four 3/8-inch-diameter bolts, two per side, with flat washers and nylock nuts.

G. Panelboards Surface Mounted to Masonry: Shall be anchored through factory-punched mounting holes in back of the panel can. Panels up to 300 lbs., minimum four, one per corner. Panels greater than 300 lbs., minimum six, one per corner and two in the middle.

H. Pad-Mounted Transformers: Shall be anchored through factory-punched mounting holes. Use Hilti "KB-TZ" anchors with minimum 3-1/4-inch embedment and install per ICC-ESR 1917. Allow extra anchor length to accommodate vibration isolation pad thickness.

3.10 FIELD QUALITY CONTROL

A. Install all equipment and components per manufacturer’s instructions.

B. Visually inspect and field verify all connections and attachments for proper tightness.

C. Coordinate inspections with the Authority Having Jurisdiction.

END OF SECTION

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:

1. Identification for raceways.

2. Identification of power and control cables.

3. Identification for conductors.

4. Underground-line warning tape.

5. Warning labels and signs.

6. Instruction signs.

7. Equipment identification labels.

8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

G. Differential values in Temperature Change subparagraph below (for aluminum in particular) are suitable for most of the United States.

1. Temperature Change: 120°F (67°C), ambient; 180°F (100°C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways Carrying Circuits at 600 Volts or Less:

1. Conduit shall be factory anodized in color as stated below. Where conduit system is colored, all junction boxes shall be required to be painted to match system color. On junction boxes that are larger than 25 inches square, only the cover of the box need be painted.

System	Color
Power – Normal System	No color (galvanized)
Emergency Power – All Systems	Orange

2. Conduits for future use shall be “No color” except where the future system is identified.

2.3 LABELS

A. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by tag manufacturer.

B. Adhesive Film Label with Clear Protective Overlay: Machine-printed, in black or white (as appropriate based on background color), by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil (0.08-mm) -thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2" x 6" (37 mm x 150 mm) for raceway and conductors.

b. 3-1/2" x 5" (76 mm x 127 mm) for equipment.

c. As required by Authorities Having Jurisdiction.

2.4 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Self-Adhesive Vinyl Labels: Preprinted flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by tag manufacturer.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid colored acrylic sleeve 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

F. Marker Tapes: Vinyl or vinyl cloth, self-adhesive wraparound type, with circuit identification legend machine-printed by thermal transfer or equivalent process.

2.5 FLOOR MARKING TAPE

A. 2-inch (50-mm) wide, 5-mil (0.125 mm) pressure-sensitive vinyl tape, with black and yellow stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, or OPTICAL FIBER.

C. Type I:

1. Pigmented polyolefin, bright colored, compounded for direct burial service.

2. Thickness: 4 mils (0.1 mm).

3. Weight: 18.5 lbs./1,000 sq.ft. (9.0 kg/100 sq.m).

4. 3 inch (75 mm) Tensile according to ASTM D882: 30 lbf. (133.4 N) and 2,500 psi (17.2 MPa).

D. Type II:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright colored, compounded for direct burial service.

2. Overall Thickness: 5 mils (0.125 mm).

3. Foil Core Thickness: 0.35 mil (0.00889 mm).

4. Weight: 28 lbs./1,000 sq.ft. (13.7 kg/100 sq.m).

5. 3 inch (75 mm) Tensile according to ASTM D882: 30 lbf. (133.4 N) and 2,500 psi (17.2 MPa).

2.7 INSTRUCTIONAL SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq.in. (129 sq.cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners, minimum one per corner.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Minimum letter height shall be 3/8 inch (10 mm). Punched or drilled for mechanical fasteners, two minimum.

B. First line of text shall include the equipment name assigned on the floor plans. Second line of text is equipment-specific.

1. Switchboards, panelboards, motor control centers, and disconnects shall include ampere rating, voltage, phase, 3- or 4-wire, and upstream source “fed from (name as appropriate).”

2. Wireways shall include ampere upstream source “fed from (name as appropriate).”

3. Transformers shall include kVA, voltage, phase, 3- or 4-wire, and upstream source “fed from (name as appropriate).”

4. Generators and UPSs shall include kW and kVA rating, voltage, phase, 3- or 4-wire, and system type; Life Safety, Critical, Equipment, Fire Pump, System-A, NEC 700, NEC 701, NEC 702, etc.

5. Transfer switches shall include ampere rating, voltage, phase, 3- or 4-wire, and on a third and fourth line of text upstream sources “Normal fed from (name as appropriate)” and “Emergency fed from (name as appropriate).”

6. Lighting controls and relay panels shall include name of general area served; Classroom Bldg. B, 1st Floor, 2nd Floor West, etc.

C. Colors:

1. Normal Power: White letters on black face.

2. Emergency Power: White letters on orange face.

3. DEVICE CIRCUIT IDENTIFICATION LABELS

D. Adhesive Film Label with Clear Protective Overlay: Machine-printed by thermal transfer or equivalent process. Minimum letter height shall be 1/4 inch (6 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

E. Text Colors:

1. Black text for normal power systems.

2. Red text for emergency or essential power systems.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: For paint materials and application requirements, comply with requirements in specification sections under 09 90 00, Painting and Coating. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws, stainless-steel machine screws with nuts and flat and lock washers, or stainless steel rivets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. For instance, vertically mounted boxes or equipment labels shall read horizontally.

B. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

C. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and Operation & Maintenance Manual. Use consistent designations throughout project.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Signs and plastic labels shall be attached with mechanical fasteners appropriate to the location and substrate.

H. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

I. Write-on tags shall be used for temporary identification of conductor and cable only. Each tag shall be changed to a permanent solution prior to project closeout.

J. System Identification for Raceways and Cables under 600 Volts: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Locate conduit labels at changes in direction, at penetrations of walls and floors, at 30-foot maximum intervals in straight runs.

2. Raceway system junction boxes shall be painted to match system color. On junction boxes that are larger than 25 inches square, only the cover of the box need be painted.

3. Locate conductor and cable circuit number labels within 9 inches of terminations and at each pull box interior.

4. Secure identifications tight to surface of conductor, cable, or raceway.

K. Underground-Line Warning Tape: During backfilling of trenches, install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

L. Painted Identification: For surface preparation and paint application, comply with requirements in specification sections under 09 90 00, Painting and Coating.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Equipment Identification Labels: On each unit of equipment, install a unique designation label that is consistent with design plans, wiring diagrams, schedules, and the Operation & Maintenance Manual. Apply labels to switchboards, panelboards, motor control centers, lighting control panels, relay panels, transformers, disconnects, wireways, generators, transfer switches, UPSs, control cabinets, and racks.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 3/8-inch (10-mm) -high letters on 1-inch (25-mm) -high label; where two lines of text are required, use labels 1-1/2 inches (38 mm) high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 3/8-inch (10-mm) -high letters on 1-inch (25-mm) -high label; where two lines of text are required, use labels 1-1/2 inches (38 mm) high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or nationally recognized testing laboratory (NRTL) rating of the enclosure.

3.2 IDENTIFICATION SCHEDULE

A. Equipment Identification: Identify each piece of electrical equipment as described in this section.

B. Accessible raceways shall be continuously color-coded per the schedule in Part 2 of this specification.

C. Junction boxes recessed in walls or ceilings shall be color-coded on the interior to match the raceway system color-code.

D. Accessible Raceways and Cables Within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall match the raceway color-coding descriptions in Part 2 and shall have either dark text over light box color or light text over dark box color, as appropriate.

E. Metal-Clad Cables, 600 Volts or Less, for Circuits More than 30 Volts, and up to 277 Volts to Ground: Install labels within 3 feet of termination.

F. Power-Circuit Conductor Identification, 600 Volts or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 Volts or Less: Use colors listed below for ungrounded conductors.

a. Color shall be factory applied or field applied for sizes larger than #8 AWG, if Authorities Having Jurisdiction permit.

b. Colors for 208/120-Volt Circuits:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

c. Colors for 480/277-Volt Circuits:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

G. Wiring Device Circuit Identification: Circuits supplying devices shall be identified on the device trim plate, panel-circuit number format.

H. Conductors and Conduit to be Extended in the Future: Attach marker tape to conductors and conduit and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with project drawings, manufacturer’s wiring diagrams, and the Operation & Maintenance Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Type 1 tape for outdoor duct banks containing power conductors.

2. Type 2 tape for other outdoor underground conduits.

3. Outside branch circuits do not require warning tape.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Outline NEC horizontal workspace requirements per NEC 110.26 Table for the applicable condition. Workspace width shall be the length of electrical equipment or 30 inches centered on equipment, whichever is greater.

END OF SECTION

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SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install occupancy sensors and related power packs, daylighting sensors and related power packs, intelligent relays, emergency relays, timer switches, and sensor related wall switches, as shown on the drawings and as specified herein.

B. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).

B. Underwriters Laboratories of Canada (ULC).

C. International Electrotechnical Commission (IEC).

D. International Organization of Standardization (ISO).

E. National Electrical Manufacturers Association (NEMA).

1. WD1 (R005) - General color requirements for wiring devices.

1.3 QUALITY ASSURANCE

A. Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. All components and assemblies are to be factory pretested and burned-in prior to installation.

C. Factory-trained technicians shall be available to functionally test each component in a programmable system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

D. System Support: Factory Applications Engineers shall be available for on-site training as well as telephone support.

E. Comply with the NEC as applicable to electrical wiring work.

F. Comply with applicable portions of NEMA Standards pertaining to types of electrical equipment and enclosures.

G. All components shall be UL listed as a system under UL 916, Energy Management Equipment.

H. All assemblies are to be in compliance with FCC Emissions Standards specified in Part 15, Subpart J, for Class A application.

1.4 SUBMITTALS

A. Submit manufacturer's product data for the lighting control devices and components. This shall include catalog sheets, specifications, and installation instructions.

B. Submit dimensioned shop drawings at a minimum of 1/8" = 1'-0" scale indicating the location of all lighting control components and accessories.

C. Submit typical wiring diagrams for all components, including, but not limited to, input devices such as low-voltage switches, vacancy and occupancy sensors, daylighting sensors, photocells, power packs, emergency control relays, and cable/wire.

1.5 GUARANTEE

A. Provide a 5-year manufacturer’s warranty on all products to be free of manufacturer’s defects. In addition to the replacement parts, this warranty shall include replacement labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design is Wattstopper. Product reference numbers contained herein are for standard products offered by Wattstopper. Subject to compliance with requirements, equivalent products from manufacturers listed below are acceptable.

1. Greengate.

2. Hubbell Control Solutions.

3. LC & D.

4. Leviton.

5. Lutron.

6. Philips.

2.2 GENERAL

A. Sensor control shall utilize Zero Crossing Circuitry.

B. Sensor shall have no leakage current to load, in Manual or in Auto/Off mode, and shall have voltage-drop protection.

C. Sensor shall provide a field selectable option to convert sensor operation from Automatic-ON to Manual-ON.

D. Where specified to be vandal-resistant type, sensor shall utilize a hard lens with a minimum 1.0 mm thickness. Products utilizing a soft lens will not be considered.

E. Sensors shall have UL rated, 94V-0 plastic enclosures.

F. Passive infrared sensors shall utilize Pulse Count Processing and Detection Signature Processing to respond only to those signals caused by human motion.

G. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).

H. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

I. Where specified, passive infrared, ultrasonic, and dual technology dual relay sensors shall offer daylighting footcandle adjustment control.

J. Dual technology sensors shall consist of passive infrared and ultrasonic/microphonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

K. Ultrasonic/microphonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

L. Ultrasonic/microphonic operating frequency shall be crystal controlled at 25 kHz within ±0.005% tolerance, 32 kHz within ±0.002% tolerance, or 40 kHz ±0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

M. Sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, and rated motor loads.

N. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

O. When specified, sensors shall utilize intelligent technology to automatically adjustable time delay and sensitivity settings.

P. Sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

Q. Bypass: In the event of failure, a manual relay override shall be provided on each sensor. When override is utilized, lighting shall remain on constantly or control shall divert to a wall switch until the sensor is replaced. This control shall be recessed to prevent tampering.

R. Sensors shall provide an LED which is responsive to presence of motion. This indicator shall be visible at all times, both in testing and normal operation.

S. HVAC Interface: Where specified, the sensor shall have an internal isolated relay with Normally Open/Normally Closed outputs for use with HVAC Control, Data Logging, and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

T. HID Controller shall:

1. Be compatible with all types of High Intensity Discharge (HID) lamps, including Metal Halide, Metal Halide Pulse Start, and High Pressure Sodium.

2. Operate with HID lamps utilizing Constant Wattage Autotransformer (CWA) type ballasts.

3. Maintain a full light level during lamp warmup for 15 minutes. Purpose: To avoid lamp damage during the HID power-up period.

4. Be compatible with any 24-VDC controlling device, such as occupancy sensors, time switches, control panels, or photocells. Purpose: To maximize lighting control scenarios.

5. Be capable of linking to other HID control modules to enable effective multi-zone control. Up to 100 individual devices shall be capable of being connected.

2.3 WALL SENSOR SWITCH

A. UW-100 Series ultrasonic/microphonic technology, single relay, line-voltage sensor. Sensor shall be capable of detection of occupancy at desktop level up to 225 square feet.

1. Sensor contacts shall have ratings of:

a. 800-W, 120-VAC ballast or tungsten.

b. 1/6-HP, 230 to 277-VAC motor.

c. 1,200-W, 277-VAC ballast.

2. Sensor features shall include:

a. Sensitivity Adjustments: Ultrasonic/Microphonic – continuous.

b. Time Delays: Auto Set, Fixed (5, 10, 15, 20, 25, 30 minutes), Walk Through, and Test Mode.

B. UW-200 Series ultrasonic/microphonic technology, dual relay, line-voltage sensor. Sensor shall be capable of detection of occupancy at desktop level up to 225 square feet.

1. Sensor contacts shall have ratings of:

a. 800-W, 120-VAC ballast or tungsten.

b. 1/6-HP, 230 to 277-VAC motor.

c. 1,200-W, 277-VAC ballast.

2. Sensor features shall include:

a. Sensitivity Adjustments: Ultrasonic/Microphonic – continuous.

b. Time Delays: Auto Set, Fixed (5, 10, 15, 20, 25, 30 minutes), Walk Through, and Test Mode.

C. DW-100 Series dual technology, single relay, line-voltage sensor. Sensor shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1,000 square feet.

1. Sensor contacts shall have ratings of:

a. 800-W, 120-VAC ballast or tungsten.

b. 1/6-HP, 230 to 277-VAC motor.

c. 1,200-W, 277-VAC ballast.

2. Sensor features shall include:

a. Sensitivity Adjustments: PIR-High/Low, Ultrasonic/Microphonic – continuous.

b. Time Delays: Auto Set, Fixed (5, 15, 30 minutes), Walk Through, and Test Mode.

D. DW-200 Series dual technology, dual relay, line-voltage sensor. Sensor shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1,000 square feet.

1. Sensor contacts shall have ratings of:

a. 800-W, 120-VAC ballast or tungsten.

b. 1/6-HP, 230 to 277-VAC motor.

c. 1,200-W, 277-VAC ballast.

2. Sensor features shall include:

a. A light level sensor to active second relay of dual relay switch.

b. Sensitivity Adjustments: PIR-High/Low, Ultrasonic/Microphonic – continuous.

c. Time Delays: Auto Set, Fixed (5, 15, 30 minutes), Walk Through, and Test Mode.

E. PW-200 Series PIR, dual relay, line-voltage sensor. Sensor shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1,000 square feet.

1. Sensor contacts shall have ratings of:

a. 800-W, 120-VAC ballast or tungsten.

b. 1/6-HP, 230 to 277-VAC motor.

c. 1,200-W, 277-VAC ballast.

2. Sensor features shall include:

a. A light level sensor to active second relay of dual relay switch.

b. Sensitivity Adjustments: PIR-High/Low, Ultrasonic/Microphonic – continuous.

c. Time Delays: Auto Set, Fixed (5, 15, 30 minutes), Walk Through, and Test Mode.

2.4 WALL SWITCH ELECTRONIC TIME SWITCHES (DIGITAL)

A. TS-400 Series digital time switch shall be wall box type, single gang, rated 120 volts, 800 watts, and 277 volts, 1,200 watts. The switch shall include a Manual Switch On, automatic function to turn lights off after a preset elapsed time, and a user temporary time override without changing the preset off. Automatic Off function shall be adjustable from 5 minutes to 12 hours. Prior to extinguishing the lights, the switch shall provide a visual and audible warning to allow occupants to reset as needed.

2.5 CEILING MOUNT SENSORS

A. CI-300 Series PIR sensor shall utilize low-voltage for control and include the companion single or dual level relay power pack/control unit. Sensor shall surface mount to a standard 4-inch octagon electrical back box. Provide manufacturer-recommended companion wall switch(es) for Manual Enable/Disable operation.

B. DT-300 Series dual technology sensor shall utilize low-voltage for control and include the companion single or dual level relay power pack/control unit. Sensor shall surface mount to a standard 4-inch octagon electrical back box. Provide manufacturer recommended companion wall switch(es) for manual enable/disable operation.

C. UT-300 Series Ultrasonic sensor shall utilize low-voltage for control and include the companion single or dual level relay power pack/control unit. Sensor shall surface mount to a standard 4-inch octagon electrical back box. Provide manufacturer-recommended companion wall switch(es) for Manual Enable/Disable operation.

2.6 CORNER MOUNT SENSORS

A. DT-200 Series dual technology sensor shall utilize low-voltage for control and include the companion single or dual level relay power pack/control unit. The sensor shall have an adjustable corner mount housing allowing placement as depicted on plans. Provide manufacturer-recommended companion wall switch(es) for Manual Enable/Disable operation.

B. CX-100 Series PIR sensor for corridors and aisles (warehouse of similar) only. This sensor shall utilize low-voltage for control and include the companion single or dual level relay power pack/control unit. The sensor shall have an adjustable corner mount housing allowing placement as depicted on plans. Provide manufacturer-recommended companion wall switch(es) for manual enable/disable operation.

2.7 EXTERIOR MOUNTED SENSORS

A. EW-Series exterior sensors shall cover 35' to 52.5' radiuses, with a field of view of 180 to 270 degrees respectively.

B. EN-100 exterior sensor shall cover up to 35 foot radius, with a field of view of 90 degrees.

C. EN 200 exterior sensors shall cover up to 100 feet, with a long-range lens view.

D. EWF exterior sensors shall include polycarbonate lamp holders that accept PAR 20 or 38 lamps up to 150 watts per lamp.

E. Exterior sensors shall have UL 773A ratings. EWF exterior sensors shall additionally have UL 1571 ratings.

F. Exterior sensors shall be manufactured with precision tooling and contain internal silicon gaskets and have an operating temperature range of -40°F to +130°F.

2.8 RELAY POWER PACK/CONTROL UNITS

A. BZ Series relay power pack/control unit shall be able to be externally mounted through a 1/2-inch knockout on a standard electrical enclosure. The unit shall be integrated, self-contained, and consist of an internally isolated load switching control relay and a transformer to provide low-voltage power. The unit shall include single or dual relays as per the control requirements, and shall provide power to a minimum of two sensors. Housing shall be plenum rated.

B. Relay contacts shall have ratings of:

1. 20 amps – 120/230/277-VAC ballast or incandescent.

2. HP – 120/230/277-VAC motor.

2.9 EMERGENCY RELAY PACK/CONTROL UNIT

A. ELCU Series emergency relay pack/control unit shall be designed to provide emergency override control (bypass) of normal power control of emergency circuit when the power to the normal power circuit is removed, UL 924 listed. The unit shall be able to be externally mounted through a 1/2-inch knockout on a standard electrical enclosure. The unit shall be integrated, self-contained, and consist of an internally isolated load switching control relay and a transformer to provide low-voltage power. The unit shall include single or dual relays as per the control requirements, and shall provide power to a minimum of two sensors. Housing shall be plenum rated.

B. Relay contacts shall have ratings of:

1. 10 amps – 120-VAC incandescent.

2. 1.0 HP – 120-VAC motor.

3. 20 amps – 120/277-VAC ballast.

2.10 INTELLIGENT RELAY POWER PACK/CONTROL UNITS

A. LC-100 Series intelligent power pack/control unit shall be a separately mounted enclosure containing four points of control: Two 0 to 10-volt dimming, two relays. Control inputs can be on/off switches, daylighting photosensor, external time controller contacts, and load shedding system contacts. The unit shall consist of internally isolated load switching control relays, each with an isolated NO/NC contact set. Unit shall include a transformer to power up to 150 mA of low-voltage devices. Pair with LS-301 photosensor for daylighting control. Housing shall be plenum rated.

B. Relay contacts shall have ratings of:

1. 20A – 120/277-VAC ballast or incandescent.

2. HP – 120/250-VAC motor.

2.11 PHOTOSENSORS

A. LS-301 Series photosensor, closed loop type, shall provide full range dimming, 0.2 to 10 VDC output voltage, and control up to 50 dimming ballasts in one zone. Provide sensor with remote control for setup and user control. Sensor shall be ceiling surface mount.

B. LS-102 Series switching photosensor, closed loop type, shall provide on-off control in conjunction with occupancy sensor and related relay power pack/control unit. Sensor shall be ceiling surface mount.

1. Features:

a. Auto Setpoint Calculation.

b. Multi-Band Photosensor Range: 1 to 1,400 fc.

c. On Setpoint Range: 1 to 850 fc.

d. Status Indicator: Multi-function green LED.

2.12 CONTROL WIRING

A. Control wiring between sensors and control units shall be Class II, #18-24 AWG, stranded UL classified, PVC insulated or Teflon jacketed cable suitable for use in plenums, where applicable. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION COORDINATION

A. A factory-authorized manufacturer’s representative shall provide the Electrical Contractor a functional overview of the lighting control system prior to installation. The Contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all devices, with special attention to placement of occupancy and daylighting sensors.

2. Review the specifications for low-voltage control wiring and termination requirements.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades and specific responsibilities regarding integration.

B. Manufacturer's representative to provide written or computer-generated documentation for use in commissioning activities on a room-by-room basis including:

1. Sensor parameters, time delays, sensitivities, daylighting setpoints.

2. Sequence of operations, manual on, auto off, etc.

C. Do not install equipment until the following conditions can be maintained in spaces to receive equipment:

1. Ambient Temperature: 0 to 40°C (32 to 104°F).

2. Relative Humidity: Maximum 90%, non-condensing.

3.2 INSTALLATION

A. Provide detailed point-to-point wiring diagrams for every termination. Provide color-coded conductors to simplify Contractor termination requirements, where using building wiring. Color codes shall be noted on the diagrams.

B. Provide wiring in accordance with the equipment manufacturer's wiring diagrams.

C. Mount devices according to the project requirements and the equipment manufacturer's recommendations. Sensors shall be mounted in such a way as to minimize coverage in unintended areas.

D. Switch and Relay Type: Provide single or dual relay control to match the lighting system installed in the room controlled.

E. Sensor Type Applications:

1. PIR sensors shall be provided in single occupancy offices, up to 300 square feet.

2. Dual technology sensors shall be provided in single person restrooms (no stalls).

3. Ultrasonic/Microphonic sensors shall be provided in other restrooms.

4. PIR sensors shall be used in aisles (warehouse or similar).

5. Dual technology sensors shall be provided in other spaces.

F. Where no ceilings are utilized, conduit must be routed from a back box at the device back to a connection point at the nearest lighting fixture or control location.

3.3 DAYLIGHTING SENSORS AND CONTROLS

A. Install and calibrate per manufacturer's recommendations. Adjust the daylighting sensor to provide even illumination between on/off sequences. The time delay shall provide adequate “dead band” to allow the passing of clouds without triggering the electric lighting off.

B. At night with no exterior illumination except moonlight, measure and record the installed electric lighting illumination level at the floor or at the desk (at regularly occupied environments) within the daylighting zone. Set the sensor target level at the nearest increment above the measured electric lighting illumination level.

3.4 FIELD STARTUP AND COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by the manufacturer’s factory-authorized representative who will verify a complete, fully functional system. Representative shall work with the Electrical Contractor to adjust each device to operate within the manufacturer's expectations for the product.

1. Calibrate all sensor time delays and sensitivity for proper coverage of occupants and for energy savings.

a. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

B. The manufacturer’s representative and the Contractor shall walk the project with the Owner to demonstrate sensor functions. Contractor shall provide both the manufacturer and the Owner with 10 working days written notice of the demonstrative project walk. The Contractor shall make adjustments to sensor operations to satisfy the Owner’s needs within the parameters of the sensor and the applicable energy code requirements.

C. Upon completion of the system commissioning, the factory-authorized technician shall provide 2 hours of training to the Owner’s designated personnel on the adjustment and maintenance of each type of component.

3.5 RE-COMMISSIONING

A. Re-commission project at 30 days from occupancy, recalibrate all sensor time delays and sensitivities to meet the Owner’s project requirements. Provide a detailed report to the Architect/Owner of re-commissioning activity.

END OF SECTION

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SECTION 26 09 24

LIGHTING CONTROL DEVICES (RELAY PANEL NETWORK SYSTEMS)

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the specifications.

B. The Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

1.2 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by the drawings and by the requirements of this section. It is defined to include, but not by way of limitation:

1. Low-voltage switching systems with lighting automation relay panels, associated low-voltage switches, and interior/exterior photocell daylight compensation.

2. Panel Master On/Off control capability.

3. Programmable panel intelligence cards with:

a. Network Timeclock.

b. Telephone Override.

c. Photocell.

d. Factory Service:

1) Documentation.

2) Programming.

3) Startup.

4) Training.

5) Extended Warranty.

B. Types of lighting control equipment and wiring specified in this section include the following:

1. Low-Voltage Lighting Automation Relay Panels.

2. Master On/Off Panel Automation Cards.

3. Master Clock System that shall control all relays within all relay panels.

C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation on control equipment and wiring. Not work of this section.

D. Conduit stubouts from switches and other devices shall be required to accessible ceilings. Where no ceilings are utilized, conduit must be routed back to the relay panel.

E. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory-installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL 924 and NFPA 70 - Article 700.

1.3 APPROVED MANUFACTURERS

A. Approved Manufacturers: Douglas, General Electric, Greengate, LC&D, Leviton, Lutron, Micro-Lite, Philips, Wattstopper, or as accepted.

1.4 QUALITY ASSURANCE

A. Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. All components and assemblies are to be factory pretested and burned-in prior to installation.

C. Factory-trained technicians shall be available to functionally test each component in a programmable system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

D. System Support: Factory Applications Engineers shall be available for onsite training as well as telephone support.

E. Comply with the NEC as applicable to electrical wiring work.

F. Comply with applicable portions of NEMA Standards pertaining to types of electrical equipment and enclosures.

G. All components shall be UL Listed as a system under UL 916 Energy Management Equipment.

H. All assemblies are to be in compliance with FCC Emissions Standards specified in Part 15, Subpart J, for Class A application.

1.5 SUBMITTALS

A. Submit manufacturer’s product data for the lighting control system and components.

B. Submit dimensioned shop drawings at a minimum of 1/8-inch = 1'-0" scale indicating the location of all lighting control system components and accessories.

C. Submit a one-line diagram of the system configuration proposed if it differs from that illustrated in the riser diagram included in these specifications and drawings.

D. Submit typical wiring diagrams for all components, including, but not limited to, relay panels, relays, input devices such as low-voltage switches, vacancy and occupancy sensors, photocells, programmable panel master switches, telephone override cards, global switching/annunciation, and wire.

E. Include all conduit requirements within the submittal. Where conduits are indicated on the Division 26 drawings, the quantity and size shall be a minimum. The vendor shall confirm all quantities and sizes on the submittal.

PART 2 - PRODUCTS

2.1 LOW-VOLTAGE RELAY SWITCHING SYSTEM

A. Description:

1. The low-voltage relay switching system shall consist of preassembled relay panels, low-voltage switches, and time controllers with astronomic feature and their associated wiring.

2. The relay panels shall be mounted in locations as indicated on the drawings. The numbered relays in the panel shall be wired to control the power to each load as indicated on the Panel Wiring Schedules included in the drawings. All power wiring shall be identified with the number of relay controlling it at the load.

3. Low-voltage switches shall be mounted in the spaces as indicated on the plans. Low-voltage wiring from the switches to the relay panel shall be Class 2 or Class 2P (plenum rated) as required by the National Electrical Code and local standards. Each low-voltage wire shall be labeled with the relay number as indicated in the schedules at each switch. Use only properly color-coded, stranded #20 AWG (or larger) wire or as indicated on the drawings. All relays and switches shall be tested after installation to confirm proper operation and the loads recorded on the directory card in each panel. Switches shall be installed in a single gang box with 3/4-inch conduit stubout to above an accessible ceiling. Where no ceiling is present, route 3/4-inch conduit to relay panel.

4. The panels shall provide expansion slots for the addition of automation cards. These cards shall be totally compatible with the manual operation of the low-voltage switches and occupancy sensors; and, in the event of a card failure, these devices shall continue to operate to provide relay control.

5. The plans shall indicate the relay number that shall be located below or adjacent to the circuit number for individual relay devices (i.e., Homerun Designation LA-1, 3 (RP-1, 2, 3, 4). Refer to lighting panel and relay panel schedules for cross-reference control requirements.

6. Master clock control system shall have the ability to control all relays as scheduled, to the total number of clock setpoints.

B. Hardware Features:

1. Modular relay panels shall consist of the following:

a. Tub: NEMA 1 enclosure sized to accept an interior with 1–8, 1–24 or 1–48 SPST or HDR SPST relays as indicated. Mounting of the tub shall be flush or surface as indicated on the drawings.

b. Interior: Bracket and circuit board backplane with pre-mounted SPST or HDR SPST relays as indicated. Interiors shall be sized to accept 8, 24, or 48 relays and will provide true On/Off indication of relay status through LEDs mounted on the circuit board. Each relay shall be capable of direct On/Off control by a low-voltage switch or occupancy sensor. The relays shall be momentary-pulsed mechanically latching contactors rated at 20 amps, 120/277 VAC. They shall attach to the interior by a single plug-in connector.

c. Power Supply: Transformer assembly quantities rated at 40 VA with separate secondaries providing power to relays, LEDs, and associated low-voltage switches. Transformers include internal overcurrent protection with automatic reset and metal oxide varistor protection against powerline spikes. 120/277 VAC, 50/60 Hz ±10%.

d. Cover: Standard tub with hinged, lockable configuration. Surface-hinged locking covers shall provide an LED status-viewing window and a lockable door for access to low-voltage wiring compartment. A wiring schedule directory card shall be affixed to the rear of the cover to allow ready identification of circuits-relays-loads controlled when the door is open.

2. Switches and Cover Plates:

a. Provide specification grade, heavy-duty, center Off toggle switches, #5935-2G (white or color specified by the Architect), as shown on the plans for overriding the relays.

b. Pushbutton Type: RS2-xxx, RP2-xxx, RMP2-35.

c. Provide specification grade cover plate material and color(s) to match the Division 26 requirements.

3. Low-Voltage Wire:

a. All low-voltage wiring shall be color coded to match the relays, switches, and sensors. It must also be UL Listed as conforming to Class 2 or Class 2P wiring requirements.

b. Switch Color Codes as follows: Red/Black/White.

c. Remote Relay Color-Coding: Red/Black/Blue/Yellow/Yellow.

4. Photocell Sensor: Each photo control point shall consist of an architecturally-compatible sensor mounted in the appropriate location for measuring the available daylighting. Each sensor will have a separate control/calibration module mounted in an enclosure in the electrical closet. The sensor shall connect to the control/calibration unit via a single 20/4 shielded conductor with a maximum distance of 500 feet. The control unit shall be powered by 24 VAC.

    a. Control/Calibration Unit:

        1) Control unit shall allow for direct control of up to three separate devices. These devices can be a relay, or any other device that allows control by a 3-wire momentary contact.

        2) Control unit shall be a standard device that can work with any of the four possible sensor devices. The unit shall be switchable between four footcandle measurement ranges (1–10 FC, 10–100 FC, 100–1,000 FC, and 1,000–10,000 FC), depending on the sensor head and application.

        3) Control unit shall have separate trip points for the high and low response settings. These settings will be entered via easily readable dial switches, and will not require a separate meter or lookup table to insure a reliable footcandle setting. LEDs shall be provided to illustrate whether the sensor is below the low setting, above the high setting, or in the deadband range.

        4) Control unit shall allow for a momentary contact device to act as a master On/Off override of the photocell relays. This master override will only be in effect until the next change in light level or the next master override.

        5) Control device shall employ a 3-minute time delay between switching outputs to avoid nuisance tripping. It shall be possible to disable the time delay to aid in initial setup and troubleshooting.

        6) Sensor Devices: Four different sensors shall be available to match the specific application. Each sensor shall employ photodiode technology to allow a linear response to daylight in its given footcandle range.

        7) For Exterior Lighting: A hooded sensor that can be horizontally mounted on a 3/4-inch KO or threaded conduit. Sensor shall employ a flat lens, and work with a footcandle range of 1–10 or 10–100, in 10% increments. The entire sensor shall be encased in optically clear epoxy resin.

5. Dataline:

    a. The Contractor shall provide for intelligence networking by providing a dataline between all panels.

    b. Dataline shall be 18/2 twisted pair (Red = +, Black = -) with shield. Rated for Class 2P. One turn per 1 inch minimum; 50 pf/ft. 1 foot maximum.

c. Maximum dataline length = 4,000 feet.

2.2 LOW-VOLTAGE SWITCHING SYSTEM WITH SOFTWIRED GROUPING CAPABILITY

A. System Description:

1. Softwired grouping capability will be enabled by adding a single relay driver card for each of the eight relays and a single Learn Mode card per panel into the base panel's expansion slots. Each relay driver card also serves to enable three separate programmable system switches.

2. Any group of relays can be softwired to any programmable system switch by:

a. Turning every relay that is to be part of a softwired group on, and all others off.

b. Pressing the Learn button on the Learn Mode card. The Learn LED will start blinking rapidly.

c. Pressing either the On or Off side of programmable system switch. At this point, the Learn LED will stop blinking, and the programmable system switch has been assigned control of that group of relays.

3. Every programmable system switch can be assigned one of two scenarios. They are:

a. On & Off: If the On side of the programmable switch is pressed when learning a group of relays, the switch will turn the relay group on when pressed on, and turn the relays off when pressed off.

b. On & Flicker, then Off: If the Off side of the programmable switch is pressed when learning a group of relays, the switch will turn the relay group on when pressed on, and will flicker the relays (turn them off for about 1 second, then turn them back on) when pressed off. 5 minutes later, all relays that flickered will go off automatically. However, any relay that is pressed on during the 5-minute wait period will be exempted from the off sweep.

4. In addition to the programmable system switches, every panel includes two master switch inputs labeled A and B that can be assigned to control any group of relays using two other scenarios:

a. Cleaning Switch: If the On side of the master switch is pressed when learning a group of relays, it has been assigned a cleaning scenario. The switch shall allow the cleaning crew to turn on any assigned relay group, but it will not turn off any relay that is scheduled On or has an occupant override in effect (i.e., occupant overrides will have priority over cleaning).

B. Hardware Features:

1. Relay Driver Cards:

a. The softwired grouping function shall be enabled by plug-in relay driver cards controlling eight relays each. The eight-relay panel shall have one relay bank (1–8) and accept one relay driver card. The 24-relay panel shall have two relay banks (1–8 and 9–16) and accept up to two relay driver cards. The 48-relay panel shall have four banks and accept up to six cards.

b. Each card shall include three associated programmable system switches which signal the Learn card to control its associated relays On/Off according to the different scenarios listed above while still allowing direct switch control of each relay. These switch inputs may be either a 2-wire or 3-wire, maintained or momentary dry contact closure.

c. Programmable switch inputs within a panel or in different panels shall be capable of being paralleled for common control. This requires that all panels be powered by circuits on the same phase.

d. Each output shall be capable of operating three relays in parallel.

2. Learn Mode Card:

a. The Learn card shall provide two momentary contact switches mounted on its front. The right switch is a relay All On/All Off override. The left button, when pushed, puts the card into the Learn Mode. The next programmable system switch that is triggered will be assigned to control all the On relays. If no programmable switch is pressed within 30 seconds, the card will cancel out of the Learn Mode and go back to its normal state.

b. The Learn Mode card shall provide two LEDs for visual status feedback. The right LED indicates that the Learn card has power and can function. The second LED is used to show memory status: Rapid Flashing means nothing in memory; Slow Flashing means that the Learn button has been pressed and the next programmable system switch that is hit will be assigned to control all the On relays; Steady On means that the card has been at least partially programmed.

c. The Learn card shall use an EEPROM to record the user-defined switch assignments, thus insuring a 40-year backup of information in case of power failure. Systems that require a changeable battery with less than a 10-year life for information backup shall not be allowed.

C. Programmable System Switches:

1. System Description:

a. Programmable system switch modules shall be added to the dataline to provide system-wide switching.

b. Each unit shall have an address setting from 01 to 99 and 16 physical switch inputs. These inputs may be either 3-wire maintained or momentary.

c. The system switch modules shall transmit the switch ID (address/input) and the action (ON/OFF) whenever a switch changes state.

d. The intelligent panels shall monitor these messages and actuate their associated relays to the appropriate state. This state to be determined by the scenario assigned to the system switch: Master On/Off, Photocell.

2. Hardware Features:

a. Universal power supply.

b. Sixteen independent 3-wire switch inputs.

c. 18/3 switchleg wiring, 1,000 feet.

d. Maximum of 1,584 programmable system switches per system.

2.3 DATALINE COMMUNICATIONS AND NETWORK TIMECLOCK

A. System Description:

1. The Learn cards in each intelligent panel shall be linked over a single dataline. The dataline shall provide a highly reliable communications bus for transferring control and status data to and from the lighting automation panels.

2. A network timeclock panel shall provide power to the dataline as well as flexible central scheduling for up to 99 Learn relay panels. The timeclock panel shall also include card slots for one optional telephone override card and two optional global switch/annunciator cards.

3. The network timeclock will provide programming and editing capability for its own schedule function. In addition, it shall provide similar programming/editing capability for all of the devices on the dataline: Learn relay panels, phone override cards, and global switching cards.

4. The network timeclock shall be capable of controlling a Learn relay panel programmable system switches (PSS) and relays. It shall do this by transmitting commands over the dataline. A typical command will consist of the PSS address (Panel#/PSS Input#) and the On or Off action desired. If the PSS address transmitted matches that of a PSS in a Learn panel, that PSS will be actuated On or Off as commanded. The relays associated with the PSS input will then be turned On or Off using the scenario (Master On/Off with Flick Warn) programmed for that input.

5. During normal operation, the network timeclock dataline commands will be annunciated on its LCD display showing the action and the time transmitted. Learn panel PSS overrides, telephone overrides, and global switch overrides will also be displayed as they occur.

B. Hardware Features:

1. Mechanical:

a. The network timeclock will be enclosed in a NEMA 1 panel with a hinged lockable door keyed the same as the relay panels.

b. The unit will include three expansion card slots: One for a telephone override card; the other two for global switch/ annunciator cards.

c. All wiring terminations will be made on a motherboard. Replacement of defective cards shall not require removal of any wiring.

2. Data Entry/Display: The data entry and display capability will stress ease of programming and the ability to confirm the operation of the unit. The following are minimum requirements:

a. 40-character by 8-line LCD backlit LCD display.

b. Function-Specific Keypad:

1) Single screen format with “fill-in-the-blank” approach to both new data entry and editing.

2) Programming manual and data sheets will be provided and a plastic sleeve included for storage inside in the unit.

3) The same data entry/display will be capable of programming the Learn panels and the other optional dataline devices (telephone and global switches).

3. Startup / Testing: The network timeclock shall provide a simple means for testing all devices on the dataline and demonstrating the operation of all program data.

4. Program:

a. The network timeclock shall allow up to 99 scheduled events, each event using the following logic:

1) ...At this time __:__.

2) ...On these days of the week (and/or holidays).

3) ...Turn On or Off.

4) ...The following group of up to 12 PSS inputs (or relays).

b. The unit shall use a 365-day clock with the ability to define up to 32 holidays by date, provide automatic Daylight Savings Time, and compensate for leap years.

c. An internal power backup shall provide up to 10-year carryover in the event of a power outage.

5. Data Retention: The user program data will be stored in EEPROM, providing 10-year data retention without external power. Units relying on batteries with limited life for data retention will not be allowed.

6. Dataline Monitoring: The network timeclock will monitor and annunciate dataline commands, including its own transmissions and those of the Learn relay panels.

7. Dataline:

   a. Dataline shall be 18/2 twisted pair (Red = +, Black = -) with shield meeting Class 2P NEC code requirements. Minimum one turn per 3 inches; 50 pf/ft. maximum.

   b. Maximum Length: 4,000 feet.

   c. Maximum Number of Relay Panels on a Dataline: 99.

2.4 DISTRIBUTED AUTOMATIC RELAY PACKS (ARPS)

A. Provide automatic relay pack (ARP) distributed lighting controllers in the locations as indicated on the plans and schedules. Each ARP shall be suitable for mounting within the ceiling plenum to a junction box through a standard 3/4-inch KO opening. ARP units shall be networked digital devices and share the dual pair digital communications network wire with the digital dataline switches where specified. Each ARP shall provide the following features:

1. NEMA 1 housing, 6.63" x 6.13" x 2.13", shall be rated for use in return air plenum spaces.

2. Each pack shall have two independent load control relays. Relays shall employ zero cross switching circuitry to extend relay life and mitigate the effects of switching high inrush ballasted loads.

3. Relay load rating shall be 20 amps ballast at 120/277 VAC, 60 Hz, 20 amps incandescent at 120 VAC, 60 Hz, 1 HP at 250 VAC, 60 Hz.

4. Provide two form C auxiliary relays, contacts rated 1 amp at 24 VDC. Auxiliary relays shall track the state of the load control relays and be suitable for interfacing the HVAC or other external systems.

5. Each pack shall provide a 200 mA, 24 VDC auxiliary power source suitable for operation and optional daylight and occupancy sensors.

6. The ARP shall receive scheduled occupancy and override commands via the digital network. The logic shall allow for tuning the sequence of operation independently for normal and after-hours operating periods.

7. Provide support for direct connection of one or two low-voltage switches. Control logic for interaction of manual switch operation with all sequences of operation shall be resident within the ARP and shall not depend upon the network connection for proper operation.

   a. Input logic shall support 3-wire or 2-wire momentary-type switches, DIP switch selectable.

b. Provision to bridge switch inputs for control of both relays from one switch.

c. Switches shall be individually programmable for Manual On/Automatic Off operation for either scheduled-based or occupancy-sensor-based operation.

B. Provide support for direction connection of a passive infrared, ultrasonic, or dual-technology occupancy sensor. The occupancy sensor signal shall be directed to both relays and shall allow selection of a different sequence of operation for each relay. Sequence of operation shall include only: On Only, Off Only, On and Off, or Disabled. It shall be possible to set a different sequence of operation for each relay during normal occupancy hours and after-hour periods as determined by the system schedule.

C. Provide support for direction connection of a daylight sensor. The daylight sensor signal shall automatically be directed to the second relay in the pack. A signal from the daylight sensor indicating that there is sufficient daylight in the space will initiate a shed condition in the logic that will turn off the second relay. When the daylight sensor indicates that sufficient daylight is present, the shed condition will be restored and the relay will return to the pre-shed logical state.

D. Unless otherwise directed on the plans or in the specifications, each ARP shall be located in the plenum above the door to the controlled room. Where conditions require variance in mounting location, the Contractor shall accurately mark the location of each ARP on the As-Built Drawings and include this information in the project manuals.

2.5 ADVANCED COMMUNICATIONS, INTEGRATION AND PC CONNECTIVITY

A. Provide an advanced communications network that supports optional features like PC connectivity, TCP/IP connections, advanced programming system documentation, enhanced diagnostics, historical and runtime accumulation, and graphic programming and control.

B. The system shall support the following advanced operating scenarios:

1. Adjustable override periods for after-hour use based upon the day of the week.

2. Preemptive override before Off to prevent blink warning and to start a new override time delay.

3. Allow common areas to remain On when specific relays in a panel are On. Egress timer starts a countdown when the last watched relay turns off.

4. Master Switch Control with blink option to provide a blink warning and 5-minute countdown for occupants when a master switch is turned off.

5. Interior daylighting control to turn off lights when available natural light meets occupants lighting needs. Lights will only come on during occupied periods when enough natural light is not available.

C. Communications:

1. Each panel shall support RS-232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow simultaneous operation of multiple communications access points to support multiple operator terminals and communications with other building automation systems (BASs).

2. Each panel shall be capable of standalone automatic operation and the network shall achieve full distributed processing.

3. All programming shall be accomplished with a Windows-based PC running compatible software package.

D. Hardware Features:

1. Each communication control card shall be capable of providing all logic, control, runtime data, status information, and communications functions for up to 48 relays in a panel.

2. EEPROM power loss memory and clock hookup time: 30 days.

3. Self-Diagnostics: Automatic diagnostics on all memory, input/output card modules, relays, and dataline.

4. Clock: Digital with time, day of week, and date, with automatic leap year compensation. Programmable Daylight Savings Time and Standard Time adjustment.

E. WinControl Software:

1. Schedules:

a. Each communication control card shall support up to 24 unique weekly schedules out of a total of 1,000 available per system. Each schedule shall allow up to eight events per day for a repeating 7-day week.

b. Up to 32 holidays may be defined for any specific date. On that date, any of the three holiday schedules may be assigned.

c. Relays may be programmed to switch to a different weekly schedule on any specific date, and then revert back to normal at another time. This allows for future schedule changes to be programmed ahead of time.

d. “Spring Ahead” and “Fall Back” dates for daylight savings time changes may be entered a full 2 years ahead. Software also supports the ability to “Auto Fill” in the next two occurrences of each of these dates.

2. Time Delay/Blink Warning: Used during unoccupied periods, assignable for each relay.

a. Used during unoccupied periods, assignable for each relay.

1) Time delays from 2 to 1,440 minutes.

2) Blink Warning: 1-second Off blink followed by a 5-minute grace period before Off.

3) An optional second blink warning 1 minute before Off.

3. Analog Photocell Configuration:

a. Enable any group switch card input (eight per group switch card) to act as an analog input into the panel for use with photocells or other analog devices.

b. Select the photocell from list of available types including:

1) Indoor, 0 to 500 footcandles.

2) Indoor, 0 to 50 footcandles.

3) Skylight, 0 to 6,000 footcandles.

4) Outdoor, 0 to 200 footcandles.

c. Establish trigger parameters for each analog input with:

1) Separate on and off setpoints.

2) Separate on and off time delays.

3) Load to be controlled by the input.

d. A total of 32 sets of trigger parameters may be established per panel.

e. Analog Photocell Monitoring: Actual footcandle light levels per photocell and the current trigger state of the loads may be read using the Operator's Software specified in this section.

f. Runtime Counters for Each Relay:

1) Cumulative runtime (up to 31 years) and number of cycles (up to 17 million) since last reset. User resettable.

2) Daily runtime for the current day and each of the prior 40 days.

3) Monthly runtime for current and 14 prior months.

g. Activity Logs:

1) Store previous relay events including the time, new state, and cause for the change in state.

2) Annunciate over the dataline and RS-232 port when the table is 25%, 50%, 75%, and 100% full.

2.6 OPERATOR'S SOFTWARE

A. User programming and editing may be conducted both online or offline in a Windows-based software application.

B. Data shall be entered through a simple menu-driven user interface.

C. The software shall simplify integration with other software products by allowing the lighting control manufacturer's components to be embedded into other Windows applications. These features shall include the following:

1. BACnet® or LonWorks® connectivity with optional WebLink.

2. Drag and drop interface programming supported throughout the program.

D. Basic operating software provides the following:

1. Site wiring documentation for all connected relay panels and system components.

2. English descriptions of each relay's circuit designation, circuit description, switch, and calculated load.

3. RS-232 and TCP/IP Connection to Lighting Control Panel.

4. Monitor/Control all relays. Software shall show actual relay states, with an optional menu showing how and when the relay state occurred, and when the next scheduled to change.

5. Simulate all functions.

E. System Parameters:

1. System software to be sized based appropriately for the system; 250, 500, 750, or unlimited relays. Any number of sites may be programmed from a single software package (based on hard drive space).

2. Passwords Matrix Features allowed per site.

3. User defines functions accessible for each password (Document, Program, Initialize, Transfer from PC, Transfer to PC, Control, Simulate/Test).

4. Configure software to automatically contact remote sites using a modem or I/P address.

F. Other Features:

1. Online help brings up a context sensitive help screen.

2. One-step menu option to back up all site information to a backup drive.

3. The software shall include Trends and Relay Runtime Analysis that will allow the operator to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.

G. System Design Capability: From the lighting control system software database, the software shall be able to automatically create a system single-line drawing, panel schedules, and specifications that can be exported in DXF format for use in standard CAD drawings.

2.7 CENTRAL PROGRAMMING, MONITORING, AND CONTROL WORKSTATION

A. Laptop computer workstation will provide monitoring, programming, and control of the system.

B. The computer will be a Pentium 4 class personal computer with monitor for enhanced color graphics display. The system shall be shipped complete with all memory, cables, and peripheral devices. The complete system shall be factory tested prior to shipment. The system shall include a minimum:

1. 3 GHz, Windows 7 Professional XP3213 IT, Dual Core/4 Threads, 3 MB Cache.

2. 17-inch LED flat panel color monitor, 16 x 9 format, anti-glare.

3. 320 GB hard drive, 7,200 RPM, SATA.

4. 4 GB Shared Dual Channel DDR3 @ 1,066 MHz, 2 DIMM.

5. 8 X DVD ± RW.

6. Lighting control software, WinXP Pro.

2.8 ETHERNET MULTI-USER CONNECTIVITY – WEBLINK

A. System Description:

1. A network appliance will provide multi-user, simultaneous access to the lighting system using standard TCP/IP and the WinControl software specified in this section.

2. All IT infrastructure that is required for connectivity shall be specified elsewhere and is not considered part of the lighting control system requirements.

3. The network appliance will include the following hardware:

a. Ethernet, Serial, and Parallel port.

b. Optional 56K BAUD internal modem.

c. Video graphics card.

B. Features:

1. Multiple users (each with a licensed copy of WinControl) will be able to simultaneously connect to the IP address of the WebLink.

2. Users may be connected via an Intranet, or Internet depending upon network security limitations.

3. Provide the capability to monitor the status of each relay and to override each relay using only a web browser.

4. A single user may connect using WinControl, via the internal modem of the WebLink.

5. The WebLink will provide all the features of a direct connected site to the simultaneous users.

C. Events Scheduler Module (Schools, Retail, and Event Centers):

1. 365 day event scheduling will allow “Events” to be defined as a series of commands to allow a preprogrammed time sequence to occur by selecting the start time and stop time of the event. Events may be programmed as a repeating schedule with specific start and ending times or as one-time scheduled events.

2. 365-day programming will simplify single day activities for schools, retail applications, or event centers. The schedules may be programmed up to 2 years in advance.

D. MyLights Personal Lighting Control Module:

1. Provide personal lighting control for multiple users via an enterprise LAN connection between the WebLink and each user’s desktop PC.

2. The system shall monitor the user’s mouse and keyboard activity and maintain lighting in the space during periods of occupancy as indicated by the PC activity.

3. Provide an adjustable Off time delay. At the expiration of the time delay after the last PC activity, the lights shall blink warn and provide an adjustable grace period before turning off the lighting. Any PC activity by the user shall cancel the impending Off action.

4. An icon on the user’s PC system tray shall provide access to set up and override features that shall include:

a. Override Off.

b. Override On for set period of time.

c. Lighting Zone Selection with password protection.

2.9 REALTIME COLOR GRAPHICS SOFTWARE

A. System Description:

1. Color graphics software WinControl Graphics, shall allow a user to monitor and control the low-voltage relays through a graphical color interface. The system will allow the user to create drawings through a graphics generator provided with the system. The system will control the relays in a real-time environment; i.e., all system changes will be communicated immediately through the color graphic screens.

2. The application will provide a visual representation of the floor plan, drawn to scale, with each fixture displayed on screen. Fixtures can automatically indicate the relay controlling them on screen. The software will include “fly overs” which will display fixture information when the mouse pointer is over a defined object on the screen.

3. The software will fully integrate with the base software; all system databases, including wiring documentation and system runtime information, will be available to the graphic software.

4. The software shall be based upon Microsoft’s Component Object Model (COM) and shall support Active-X technology for integration.

5. The software shall include color graphic screens created by a factory-authorized representative. These screens will be provided based on the Owner’s requested illustrations.

B. Graphic Screen Features:

1. The graphic software will allow full programming of the system from the animated graphic floor plans.

2. The operator will be able to zoom in and pan the floor plan for more detail.

3. The system shall be provided with a matrix password table to allow any user access to individual, selectable features.

4. Manual control of the relays, or simulation of system wide functions, shall be possible by a single click of the mouse.

5. Programmable “action spots” will allow an operator to pre-define commonly used manual control functions, or allow the operator to jump to other color graphic screens.

6. System animation will support multi-ballast control of a fixture representing multi-level lighting, as well an animation for monitoring of fans or other “animated devices.” Animation will also include a “Failure” definition to occur in event of relay failure.

7. Relay definitions and circuit numbers from the base software will be displayed on screen when requested by the user. Relay circuit numbers will be automatically displayed inside the fixture to provide useful information to the operator.

C. Graphic Screen Generation:

1. The Contractor shall provide CAD floor plans to the manufacturer for generation of graphic screens.

2. As-built relay panel and reflected ceiling documentation must be provided to the manufacturer before graphic screen development can begin.

2.10 TELEPHONE OVERRIDE

A. System Description:

1. Four telephone override modules shall be connected to the dataline. Each module will have its own extension number and associated RJ11 jack.

2. The phone override module will allow existing touchtone phones to initiate a dataline command to control up to 12 programmable system switches (or relays) using the following logic:

a. When the following ID code is followed by a 1# (0#).

b. Turn On or Off.

c. The following group of up to 12 PSS switch inputs (or relays).

3. Each phone module shall be capable of storing up to 99 four-digit phone override ID codes. Each code may be defined as “On Only” or “On/Off.”

B. Hardware Features:

1. Up to nine telephone control modules per dataline.

2. Plugs into available card slots in RCLOCK or RDLPWR-1 with all wiring terminations on the motherboard.

3. Up to 99 phone codes per unit, each code controlling up to 12 PSS inputs.

4. User data stored in EEPROM, providing 10-year data retention without external power.

2.11 BACNET® BASED DIGITAL COMMUNICATIONS

A. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with BASs and other intelligent field devices. Digital communications shall be RS-485 master/slave token passing based using the BACnet® protocol.

B. The panel shall have provision for an individual BACnet® device ID. The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

C. The panel shall support MS/TP MAC addresses in the range of 0–127 and baud rates of 9,600k, 38,400k and 76,800k bits per second.

D. Lighting control relays shall be represented as binary output objects in the instance range of 1–48. The state of each relay shall be readable and writable by the BAS via the object present value property.

E. The eight channel groups associated with the panel shall be represented by binary value objects in the instance range of 1–8. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the Occupied Mode. Commanding 0 or NULL shall put the relays into the Unoccupied Mode.

1. Setup and commissioning of the panel shall not require manufacturer specific software or configuration tools of any kind. All configuration of the lighting control panel shall be performed using standard BACnet® objects. Provide BACnet® objects for panel setup as follows:

    a. Analog value objects in the instance range of 1–48 (one per relay) shall assign relays to channel groups in the range of 1–8.

    b. Binary value objects in the instance range of 101–108 (one per channel group) shall assign the channel to follow Auto On or Manual On Mode when transitioning to Occupied.

    c. Analog value objects in the instance range of 101–108 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-second grace time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep-type automatic wall switches.

    d. Analog value objects in the instance range of 211–208 (one per channel) shall assign an after-hour time delay value to the channel in the range of 1–240 minutes.

    e. Multi-state value objects in the instance range of 1–8 (one per channel) shall provide the state of the relays assigned to the channel. Valid states shall be All On, Mixed, Blink, and All Off.

2. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

3. The BO and BV objects shall support BACnet® priority array with a relinquish default of Off and Unoccupied respectively.

2.12 LONWORKS® BASED DIGITAL COMMUNICATIONS

A. The lighting control panel shall support digital communications to facilitate the extension of control to include multiple panels and other intelligent field devices. Digital communications shall be LonWorks® based and use the LonTalk® protocol in an open topology architecture.

B. Dataline communications wire shall be #18 AWG, four unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline shall be topology free and can be run in a serial, “T,” or star configuration.

C. The dataline wire will be supplied by the equipment manufacturer and will include the manufacturer’s name and catalog number printed on the wire jacket. The Contractor, at their own expense, will replace an improper dataline wire.

D. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.

E. Intelligent field devices supported shall include digital dataline switches, network clock/programmer, telephone interface module, BMS interface module, photocell control module, programmable thermostat, and universal switch module.

PART 3 - EXECUTION

3.1 SUPPORT SERVICES

A. System Startup: Manufacturer shall provide a factory-authorized technician to confirm proper installation and operation of all system components.

B. Training: Manufacturer shall provide a factory-authorized Application Engineer to train the Owner's personnel in the operation and programming of the lighting control system.

C. The technician shall provide training on the lighting control features of the panel and shall verify that the panel is communicating with the BAS.

D. The system integrator or BAS vendor shall be responsible for all integration, including the mapping of BACnet® objects into the BAS logic, schedules, and graphics.

E. Documentation: Manufacturer shall provide system documentation, including:

1. System one-line showing all panels, number and type of switches and sensors, dataline, programmable system switches, and telephone override modules.

2. Drawings for each panel showing hardware configuration and numbering.

3. Panel wiring schedules.

4. Typical wiring diagrams for each component.

F. Programming: Manufacturer shall provide system programming including:

1. Wiring documentation.

2. Programmable panel and system switch operation.

3. Telephone overrides.

4. Operating schedules.

G. Extended Warranty: Manufacturer shall provide a 5-year extended warranty in addition to a required 1-year warranty for all system components.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install switchboards as herein specified and as shown on the drawings.

B. Related Requirements:

1. Specification Section 26 05 48, Vibration & Seismic Controls.

2. Specification Section 26 05 53, Identification for Electrical Systems.

3. Specification Section 26 09 13, Power System Metering.

4. Specification Section 26 28 13, Overcurrent Protection.

5. Specification Section 26 43 13, Surge Protection for Low-Voltage Electrical Power Circuits.

1.2 REFERENCES

A. The low-voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable versions of the following standards:

1. NEMA PB-2.

2. UL Standard 891.

3. UL Standard 1066.

4. UL Standard 489.

1.3 ACTION SUBMITTALS

A. Submit product literature and data including:

1. UL listing.

2. Enclosure NEMA type.

3. Bus rating and material including plating.

4. Integrated short-circuit rating.

5. Equipment elevation with devices populated and identified.

6. Bus isometric.

7. Dimensional information, by section and overall.

B. In addition to the requirements of Specification Section 26 05 00, General Provisions, submit switchboards used for utility power entrance and metering to the serving utility for design review and acceptance prior to fabrication.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals: Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.5 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.6 QUALITY ASSURANCE

A. Plant of manufacture shall be ISO 9001 or ISO 9002 certified.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.7 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations: Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above switchboards is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are Eaton, General Electric/ABB, Siemens, and Square D.

2.2 GENERAL

A. Switchboards shall be UL 891 listed, of the dead-front, safety type, with voltage and ampere capacity as indicated on the drawings. NEMA 250 Type 1 for indoor and Type 3R for outdoor applications. Other NEMA 250 requirements will be noted on the one-line drawings.

B. Switchboard framework shall be fabricated on a die-formed steel base or assembly consisting of formed steel and commercial channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting. The framework is to be formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing and component devices during shipment and installation. Exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray. Each switchboard section shall have an open bottom and individual removable top plate for installation and termination of conduit. Top and bottom conduit entry area is to be clearly shown and dimensioned on the shop drawings. All front plates used for mounting meters, selector switches, or other front devices shall be hinged with all wiring installed and laced with flexibility at hinged side. All closure plates shall be screw-removable and small enough for easy handling by one man. Side wiring gutter covers on all switchboards shall be hinged for access to wiring space.

C. Switchboard interior structure shall include section barriers,.

D. Switchboard bussing shall be plated copper and sized at 1,000 amps/sq.in. by the UL temperature rating process. Bus bars shall extend the full height of the switchboard and shall be rigidly braced to comply with the integrated equipment rating of the switchboard. Main horizontal bus bars between sections shall be full size for their entire length and located at the back of the switchboard to permit a maximum of available conduit area. End sections shall have bus bar provisions for future addition of a switchboard section as indicated on the drawings. Provisions shall include bus bars installed to the extreme side of the switchboard and pre-punched to facilitate future bolted splice plates. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers. Vertical bus bars shall extend the full height of each section and be predrilled on universal centers to allow connections to any standard-sized branch unit. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings. Provide a 25% minimum ground bus running the full length of the switchboard, but in no case smaller than 1/4" x 2" copper.

E. Mechanical-type lug terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75°C for conductor size indicated on the drawings.

F. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

G. Switchboards shall be listed for front access only, except as shown or noted otherwise on the plans. Where rear access is required, the rear compartment shall be provided with hinged door panels.

H. Each switchboard, as a complete unit, shall be given a single integrated equipment short-circuit rating by the manufacturer. Such rating shall be established by actual tests by the manufacturer on equipment construction similar to subject switchboard. This test data shall be available and shall be furnished upon request.

I. Switchboards shall have a minimum integrated equipment short-circuit current rating of 65,000A RMS symmetrical amperes, or as otherwise noted on the drawings.

2.3 ACCESSORIES

A. Switchboards shall be provided with digital ammeter and voltmeter where indicated on the drawings. Stated functions may be combined into one device.

B. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.4 MISCELLANEOUS DEVICES

A. Key interlocks shall be provided as indicated on the drawings.

B. Control-power transformers with primary and secondary protection shall be provided, as indicated on the drawings, or as required for proper operation of the equipment.

1. For outdoor (NEMA 3R) installations, each section of the switchboard shall be provided with a thermostatically controlled space heater. Power for the space heaters shall be obtained from integral control-power transformers.

2.5 CIRCUIT BREAKERS

A. All main breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

B. Circuit breakers shall be UL 489 listed, molded case with thermal magnetic trip units up to 400A and solid-state trip units for larger sizes, equipped with bus connectors. Provide accessories required to achieve described operation(s)/controls. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. Breaker interrupting capacities shall be as indicated on the drawings, and adequate for the available fault current.

C. The front faces of all circuit breakers shall be flush with each other. Provide 3/4-inch-tall, permanent, individual circuit numbers affixed uniformly to each breaker position.

D. Each breaker serving a transformer shall be provided with padlock provisions allowing it to be locked in the OFF position.

2.6 FUSIBLE SWITCHES

A. Fusible switches 800 amperes and smaller shall be horsepower rated, quick-make, quick-break, with a minimum contact interrupting rating of 14 times their continuous current rating. All devices shall have cover interlocked to prevent opening door when switch is energized. The door interlock shall be defeatable by qualified personnel. It shall be possible to padlock each device in the OFF position.

B. Fusible switches 400–600 amperes shall be designed to accept Class J or R fuses as indicated on the plans.

C. Fusible switches 601–800 amperes shall be designed to accept Class L fuses as indicated on the plans.

D. Fusible switches 100 and 200 amperes shall be designed to accept both Class R rejection-type and Class J fuses. Fuse landing block mounting shall be positioned for the fuse type indicated on the plans.

E. Fusible switches 30 and 60 amperes shall be designed to accept Class R rejection-type fuses.

F. The front faces of the fusible switches shall be flush with each other. Provide 3/4-inch-tall, permanent, individual circuit numbers affixed uniformly to each switch position.

2.7 GROUND-FAULT PROTECTION

A. Ground-fault protection (GFP) shall be provided at the service mains operating at greater than 150 volts to ground and rated over 800 amps, or where indicated on the drawings.

B. Reference Specification Section 26 28 13, Overcurrent Protection, for specification of equipment and devices.

2.8 SERVICE ENTRANCE RATINGS

A. Switchboard shall be provided with Service Entrance (S.E.) rating where used as a utility service connection point with utility metering equipment.

2.9 SURGE PROTECTIVE DEVICE (SPD)

A. Where an SPD is noted on the plans, the SPD shall comply with Specification Section 26 43 13, Surge Protection for Low-Voltage Electrical Power Circuits, and at a minimum meet the following:

1. The SPD shall be factory installed integral to the switchboard by the original equipment manufacturer.

2. The SPD shall be of the same manufacturer as the switchboard.

3. Where located at Service Entrance labeled equipment, SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

5. The SPD shall include a listed disconnecting means. The disconnect shall be located in the immediate proximity of the SPD.

2.10 UTILITY POWER ENTRANCE AND METERING

A. Pull section and metering compartments shall be manufactured to the specifications of the serving utility.

B. Where utility metering is indicated on the drawings, furnish interior barriers per the utility company specifications. This compartment shall include a hinged sealable door(s). Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per NEC and local code requirements.

2.11 IDENTIFICATION

A. Comply with requirements of Specification Section 26 05 53, Identification for Electrical Systems.

2.12 CONTROL POWER

A. Control Circuits: 120 VAC, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.13 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

B. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

PART 3 - EXECUTION

3.1 DEVICE MOUNTING

A. Circuit breakers shall be group mounted, modular sized, and designed to be individually front-removable and easily interchangeable.

B. Fusible switches shall be group mounted, modular sized, and designed to be individually front-removable and easily interchangeable. Sizes 200A and smaller shall be designed to accept Class R fuses with rejection pin installed, and prefabricated to accept Class J fuses with repositioning of the fuse clip and output lugs.

3.2 INSTALLATION

A. Arrange for delivery and installation of each switchboard prior to construction of major walls and/or roof, or provide for suitable openings to properly install the switchboard. No allowance will be made for failure to comply with this requirement. All necessary corrections shall be the responsibility of the Contractor at no additional cost to the Owner.

B. Equipment Mounting: Install switchboards on a 4-inch raised concrete housekeeping pad sized 2 inches larger than the equipment footprint. Dowel attach to concrete floors where poured separately. Where switchboard is used for a utility power entrance, provide a concrete pad in accordance with the serving utility regulations.

1. Conduit entries from the bottom shall extend 2 inches (50 mm) above concrete base after switchboard is anchored in place.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Move each switchboard in sections to the location indicated on the drawings. Completely assemble the switchboard, shim the entire structure level with metal stock, securely bolt to the concrete pad, caulk or grout any gaps at floor line. Prior to final inspection, apply factory touchup paint to any scratches, scrapes, etc., on switchboard enclosure.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

E. Install filler plates in unused spaces in sections, overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker coordination settings.

F. Install spare-fuse cabinet.

3.3 UTILITY POWER ENTRANCE AND METERING

A. Coordinate requirements and gain switchboard submittal acceptance from the serving utility company prior to equipment fabrication.

B. Obtain concrete support pad requirements from the serving utility prior to installation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Acceptance Testing:

a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.

b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.

3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Correct malfunctioning units onsite where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included by name and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install distribution, coordination, and branch circuit panelboards as specified herein and as indicated on the drawings.

B. Related Requirements:

1. Specification Section 26 28 13, Overcurrent Protection.

2. Specification Section 26 43 13, Surge Protection for Low-Voltage Electrical Power Circuits.

1.2 REFERENCES

A. The panelboards and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA and UL as follows:

1. UL 67 – Panelboards.

2. UL 50 – Cabinets and Boxes.

3. NEMA PB1.

4. UL 98 – Fusible Switches.

1.3 ACTION SUBMITTAL

A. Submit product literature and data including:

1. Certifications and UL listing.

2. Enclosure materials and NEMA type.

3. Bus rating and material including plating.

4. Integrated short circuit rating.

5. Main type and rating.

6. Cable terminal sizes.

7. Dimensional information.

8. Overcurrent device layout.

9. Overcurrent device data.

10. Published data for selective coordination device combinations to be applied to this project.

11. Seismic certification where required for the project.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Circuit Breaker Branch Panelboards: ABB, Eaton, Siemens, and Square D.

B. Acceptable Manufacturers for Distribution Panelboards: ABB Spectra Series, Eaton PRL3 (225A max branch) PRL4, Siemens P3 (225A max branch), P4, P5, and Square D I-line.

C. Acceptable Manufacturers for Coordination Panelboards: Cooper/Bussmann or Siemens.

2.2 GENERAL

A. All bus bars shall be copper, located in the rear of the panelboard cabinet. Bus bars shall extend vertically to provision each pole space scheduled and each space noted on the one-line drawing or specified herein. Provisions shall include pre-drilled bolt-on/plug-on connection points on universal centers to allow connection or insertion of standard-sized branch overcurrent devices. Overcurrent devices shall mount into suitable supporting members at the front of the cabinet that are connected with suitable lugs to the bus bars in the rear of the cabinet. Individual overcurrent devices shall be removable from the cabinet without disturbing adjacent units and without removing the main bus connectors.

B. Enclosure shall be NEMA 250 Type 1 for indoor applications and Type 3R with gasketed door for outdoor applications.

C. Feeder lug sizes shall accommodate the specified conductor size and quantities. Coordinate with one-line diagrams on the plans.

D. The minimum interrupting rating of circuit breakers shall be 10,000 amps. Refer to the drawings for higher interrupting rating requirements.

E. Locks shall be provided on all panelboards. All locks shall be keyed alike.

F. Panelboards shall be equipped with 100% rated neutral bus bar and an equipment ground bar.

G. Where specified on the plans, provide panelboards listed for use with non-linear loads and include a 200% rated neutral bus bar.

H. Where specified on the plans, provide panelboards equipped with isolated ground bars in addition to the equipment ground bars. Each isolated ground bar shall include termination positions matching the number of single circuit poles in the panelboard.

I. Each panelboard shall be identified as outlined in Specification Section 26 05 53, Identification for Electrical Systems.

J. Each panelboard shall have a two-column circuit index directory card with a clear plastic cover mounted on the inside of the door.

K. All panelboards shall have door-in-door trim to allow access to wireways and line/load lugs without removing front covers. Surface-mounted type may have the entire cover hinged in lieu of a second door for access to wiring.

L. Surface trims shall be the same height and width as box. Flush trims shall overlap the box by 3/4 inch on all sides.

M. Panels occurring in kitchen areas shall have 304 stainless steel flush trim and door.

N. All panelboard enclosures shall have blank end-walls. The use of knockout type end-walls is prohibited.

2.3 DISTRIBUTION PANELBOARDS

A. Designed to accept branch circuit breakers 225 amp frame size minimum and larger frame sizes as shown on the plans.

B. Minimum integrated SCCR rating shall be 18,000 symmetrical rms.

C. Provide physical space to accommodate future circuit breakers as noted in schedules. Minimum of one 225AF.

2.4 COORDINATION PANELBOARDS

A. Coordination panelboards shall have a tested combination of overcurrent devices that yield selective coordination from 0.01 second. Overcurrent devices may be fuses or circuit breakers or a combination thereof.

B. Main fuse shall be provided where indicated on the drawings, Class J.

C. Branch circuit devices shall include a non-defeatable interlock to prevent removal of fuse under load. Branch fuses shall be finger-safe type TCF. Fuse holders shall be rated for the ampacity of the branch circuit as scheduled. Holder may accept fuses with lower ratings but shall reject fuses with larger ratings. Provide lockout/tagout provision for each branch circuit position.

D. Panelboard shall include spare fuse storage behind the panel door that is accessible without removing the dead-front. Storage to accommodate up to six branch fuses.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards straight and true without distortion of the box. Properly support, secure and adjust enclosures, interiors and trims. Unless otherwise indicated, mount panelboards with centerline 5'-0" above floor, but with top edge of trim not to exceed 6'-6" above floor.

1. Locate panelboards in such a way as to comply with working clearances described in NEC 110.

2. Panelboards shall have a minimum of four points of attachment.

B. Surface-Mount Panelboards:

1. Panelboards mounted in spaces with a drywall finished surface shall be secured to horizontally mounted metal framing channels spanning at least two vertical studs. Horizontal channel shall be secured at each end and to each stud spanned.

2. Panelboards mounted in spaces with exposed concrete or CMU wall surfaces shall be secured to the wall with embedded anchors rated for the weight of the panelboard.

3. Panelboard mounting shall be accomplished through pre-punched holes identified by the manufacturer for anchoring.

4. Metal framing channel shall be steel, maximum of 1" deep and minimum 12 gauge.

C. Flush-Mount Panelboards:

1. Field-coordinate flush-mount panelboard locations with the General Contractor to assure the wall depth is adequate to achieve a flush installation.

2. Mount recessed panelboards with back box front uniformly flush with wall finish.

3. Stub two 3/4-inch conduits and one 1-inch conduit into the nearest accessible ceiling space.

D. Identify each circuit phase conductor with a number tag corresponding to the pole number the conductor is terminated on.

E. Create a directory to indicate installed circuit loads; incorporate the Owner’s final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door within the holder.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Provide factory-made closure plates for all unused pole positions.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all wiring devices as shown on the drawings and as herein specified.

1.2 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's product information for each item, including but not limited to voltage and ampere ratings, materials, finishes, and related accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Switches, Receptacles, and Device Plates: Basis of design is Hubbell. Product reference numbers contained herein are for standard products offered by Hubbell. Subject to compliance with requirements, equivalent products from manufacturers listed below are acceptable.

1. Eaton/Arrow-Hart Wiring Devices.

2. Legrand/Pass & Seymour.

3. Leviton.

B. Wall Box Dimmers: Basis of design is Lutron Electronics Co., Inc., Maestro Series. Product reference numbers contained herein are for standard products offered by Lutron. Subject to compliance with requirements, equivalent products from manufacturers listed below are acceptable.

1. Hubbell Control Solutions #RS Series.

2. Leviton #Decora Digital Series.

3. nLight #nPODM Series.

4. Sensor Switch #sPODM Series.

5. Wattstopper #Radiant Series.

C. Miscellaneous Devices: Manufacturers are noted in the product descriptions.

2.2 SWITCHES

A. All LINE-VOLTAGE switches shall be of the quiet mechanical type, specification grade, 20 amps, 120/277 VAC as follows:

Device	Model No.
Single Pole	1221
Two Pole	1222
Three-Way	1223
Four-Way	1224
Pilot Light	1221PL 120V 1221PL7 277V
Single Pole – weatherproof neoprene cover	HBL1750
Single Pole – weatherproof neoprene cover with pilot light	HBL1785

B. All LOW-VOLTAGE switches shall be of the quiet mechanical type, specification grade, 3-position, 2-circuit momentary contact, center off, 15 amps, 120/277 VAC as follows:

Device	Model No.
Toggle Type – Center Position	HBL1556

C. Switch color shall be selected by the Architect.

D. All LINE-VOLTAGE switches shall have the ON and OFF positions indicated on the handle.

E. If switches of higher ampere ratings are required, they shall be of similar type and quality to those shown above.

2.3 WALL BOX DIMMERS

A. Magnetic low-voltage dimmers shall be slide-to-off control. Dimmer shall be rated for use with magnetic transformers. Provide wattage rating based on load to be controlled at 125%.

B. Electronic low-voltage dimmers shall be slide-to-off control. Dimmer shall be rated for use with electronic transformers. Provide wattage rating based on load to be controlled at 125%.

C. 0–10 volt low-voltage dimmers shall be slide-to-off control. Dimmer shall be rated for use with fluorescent dimming ballasts or LED drivers. Provide wattage rating based on load to be controlled at 125%. Provide matching 3-way or 4-way switch(es) as appropriate.

D. Coordinate all fluorescent, LED, and low-voltage dimmers with the controlled load voltage and lighting fixture component interface requirements.

E. All requirements of “switches” apply.

2.4 RECEPTACLES

A. All convenience receptacles and special outlets throughout shall be grounding type.

B. Receptacles shall be specification grade, back- or side-wired, parallel slot, 2-pole, 3-wire, 20 amps as follows:

Device	Model No.
Single	5361
Duplex	5362
Controlled – 50%	BR20C1
Controlled – 100%	BR20C2
Clock Outlet	HBL5235
Isolated Power	IG5362
Weather Resistant	BR20_WR
Tamper Resistant	5362TR
Ground Fault Circuit Interrupters	GFST20
Tamper Resistant & GFCI	GFTRST20
Surge Protected Receptacle	HBL5362_SA
Surge Protected & IG Receptacle	IG5362_SA
USB Charging Duplex	USB20X2
USB Charging Only	USB4

C. If receptacles of higher ampere ratings are required, they shall be of similar type and quality to those shown above.

D. USB charging receptacles shall provide 5 VDC, 3.0 minimum total charging current. Regulated output shall be compatible with USB 1.0/2.0/3.0 device including Apple products. USB ports shall include standard and USB-C types and be rated for a minimum of 10,000 insertions and removals.

E. Special receptacles shall be as noted on the drawings. Furnish caps for all special outlets.

F. Modular power termination type device connectors are acceptable.

2.5 MISCELLANEOUS CONTROLS

A. Digital Timers: Digital time switch shall be wall box type, single gang, rated 120 volt, 800 watt and 277 volt, 1,200 watt. The switch shall include a Manual Switch On, Automatic function to turn lights off after a preset elapsed time, and a user temporary time override without changing the Preset Off. The Automatic Off function shall be adjustable from 5 minutes to 12 hours. Prior to extinguishing the lights, the switch shall provide a visual and audible warning to allow occupants to reset as needed. Wattstopper TS-400 Series or as accepted.

B. Fan Controls:

1. Fan controller shall provide continuous slide speed control with slide-to-off feature. Provide wattage rating based on load to be controlled at 125%. Lutron Model Nova T-star #NTFS Series.

2. Additional Acceptable Manufacturers: Wattstopper Model ADFC Series or as accepted by the Architect.

2.6 DEVICE PLATES

A. Provide wall plates for all wiring devices and outlet boxes, including special outlets, sound, signal, and telephone outlets, etc., as required. All cover plates shall be appropriate for type of device.

B. All plates throughout shall be specification grade nylon, color to match wiring devices, EXCEPT:

1. Where devices occur in mirrored surfaces, provide mirrored cover plates.

2. Where devices occur in food service and kitchen areas, provide brushed stainless-steel cover plates.

C. Where a receptacle is noted as weatherproof (WP), provide “extra duty weatherproof while in use” cover with padlock hasp, NEMA 3R rated consisting of cast aluminum material TayMac MX Series or as accepted.

D. Weatherproof plates for switches shall be single cover, Hubbell HBL7420.

2.7 INSTALLATION

A. Verify location and mounting height of all receptacles, wall-mounted fixtures, switches, and other equipment before roughing in. Refer to the drawings for pertinent information. Refer questionable cases to the Architect.

B. Any receptacle mounted within 6 feet of a sink or basin shall be provided with ground fault protection for personnel.

C. Any 125 VAC, 15- or 20-amp rated device located in a kitchen shall be provided with ground fault protection for personnel.

D. Each receptacle protected by an upstream ground fault circuit protection device shall include a label stating “GFCI Protected” on the trim face.

E. Devices shall be mounted parallel and perpendicular to building lines.

F. For a more attractive installation, all devices at the same location shall be ganged. Separate boxes shall not be acceptable.

G. Low-voltage control wiring routed above ceilings without conduit shall be tied off to lighting fixture support wires. In open ceiling areas, support from appropriate hooks or rings. Excess wire shall be neatly coiled without kinks or sharp bends.

2.8 MOUNTING HEIGHTS

A. Switches shall be installed at heights matching the architectural elevations. In no case shall switches be mounted higher than 44 inches above finish floor (AFF) to the top of box (or gang outlet ring).

B. Receptacles shall be installed at heights matching the architectural elevations. In no case shall receptacles be mounted lower than 15 inches to bottom of box (or gang outlet ring) above finish floor (AFF) to the bottom of the lowest plug point or where intended for ADA access, more than 44 inches AFF to the top of box (or gang outlet ring). Receptacles noted at higher mountings shall only be for a specific purpose, not general use.

C. Groups of switches shown at one location shall be installed under a single plate having the proper number of openings, and appropriate to the location.

D. The Contractor shall review the Architect's elevations and details to confirm device placement prior to rough-in. Submit questionable mountings to the Architect for direction.

2.9 WEATHERPROOF DEVICES

A. Devices shall be positioned according to the cover manufacturer's listing instructions, e.g., horizontal versus vertical mounting.

2.10 WALL BOX DIMMERS

A. Adjust dimmer faceplate spacing to accommodate full dimmer wattage. Do not remove heat sink fins/rails.

B. Coordinate dimmer wattage with circuit load to be controlled prior to ordering. Consider fixtures at maximum lamp wattage per NEC 210.21 and 220.14(D).

C. Install equipment in accordance with manufacturer's recommended application wiring and installation instructions.

D. Label each dimmer, indicating which load or zone it controls.

2.11 CONTROLLED RECEPTACLES

A. Where code required, controlled duplex receptacles shall be installed with 50% or 100% automatic occupancy control. Unless specifically indicated on the drawings, all duplex receptacles within each space required to have controlled receptacles shall be the 50% controlled type.

B. Provide all required components to facilitate the operation of controlled receptacles to "ON" when a space is occupied. This may require occupancy sensor, power pack/relay, a wireless signal pack, and a wireless receiver receptacle for individual or multiple receptacle control if applicable.

C. Each controlled receptacle shall have the universal receptacle control symbol indicated for 50% or 100% operation as denoted per NEC 406.3(E).

END OF SECTION

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SECTION 26 28 13

OVERCURRENT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install fuses and circuit breakers as specified herein and as indicated on the drawings.

B. Related Requirements:

1. Specification Section 26 24 13, Distribution Switchboards.

2. Specification Section 26 24 16, Panelboards.

3. Specification Section 26 28 16, Enclosed Switches & Circuit Breakers.

1.2 ACTION SUBMITTALS

A. Submit with specific equipment submittal:

1. Short circuit interrupting data, trip unit type, power monitoring, and other features provided for each different type of overcurrent device.

2. Fuse short circuit interrupting data and melt time curve.

3. Include UL series combination rating data, where applicable.

4. Selective coordination documentation literature for each combination to be utilized.

5. Clearly indicate each rating and/or combination being utilized.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design fuses 0 to 600V are manufactured by Bussmann. Subject to performance as compared to the basis of design fuse, the following manufacturers are acceptable:

1. LittelFuse.

2. Mersen.

B. Circuit breakers shall be manufactured by the same manufacturer as the equipment within which they are installed.

2.2 MATERIALS

A. General: Provide termination lug quantities to accommodate conductor sizes and quantities shown on the drawings. Increase circuit breaker frame sizes as required.

B. Fuses 0 to 600V:

1. Fuses 601 amperes and larger shall be UL Class L, current-limiting, time-delay, 600-volt, with interrupting rating of 200,000 amperes RMS symmetrical (Bussmann KRP-C).

2. Fuses 600 amperes and smaller shall be UL Class RK1, current-limiting, time-delay, rejection-type, 600-volt or 250-volt, with interrupting rating of 200,000 amperes RMS symmetrical (Bussmann LPS-RK or LPN-RK). Ampere ratings as noted on the plans.

3. Coordination panelboard fuses shall be as follows:

   a. Branch: UL Class CF, finger safe cube type, current limiting, and status indicating (Bussmann TCF).

   b. Main: UL Class J.

4. Fuses shall be applied considering upstream devices, in accordance with their UL series combination ratings. All applications of fuses shall be on a single fuse per phase leg basis.

5. Furnish and deliver spare fuses to the Owner as follows:

   a. Three spares for each type and size, in excess of 60 amperes, used for initial fusing.

   b. 10% or a minimum of three spares for each type and size, up to and including 60 amperes, used for initial fusing.

6. Provide a NEMA-12 spare fuse cabinet with appropriate shelving, and size as required to accommodate spare fuses supplied. Hoffman, Hammond, or as accepted. Provide micarta nameplate, 1" x 4", laminated, black text on white, with script “SPARE FUSES.”

C. Circuit Breakers, Molded-Case (UL 489):

1. Circuit breaker types shall be as graphically depicted on the one-line drawings and in accompanying notes. Types shall be molded-case solid-state, and molded-case thermal-magnetic.

2. Thermal-magnetic circuit breakers shall be trip-free, quick-make, quick-break, with handles clearly indicating rating and position (ON, OFF or TRIPPED).

3. Solid-state (SS) circuit breakers shall be equipped with a true RMS sensing, solid-state tripping system consisting of at least three current sensors, microprocessor-based trip device, and trip actuator. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection. The unit shall be trip-free, quick-make, quick-break, with handles clearly indicating rating and position (ON, OFF or TRIPPED).

4. Trip Units: Trip unit functions are specified with graphical depictions and notes on the one-line drawings.

5. Where series combinations are noted to be applied on the plans, UL series combination ratings shall be maintained with upstream overcurrent device(s).

6. For distribution panels, lighting and appliance panels, or for individual mounting, circuit breakers shall have an interrupting rating no less than the available duty at the breaker. The following minimum duties shall apply where not otherwise specified:

	RMS-Symmetrical	
100A Frame		
15A to 100A	14,000A @ 277V	10,000A @ 120/240V
225A Frame		
70A to 225A	22,000A @ 480V	25,000A @ 240V
400A Frame		
250A to 400A	30,000A @ 480V	42,000A @ 240V

7. Circuit breakers in 120/208V branch circuit panels shall have an interrupting rating of 10,000A RMS symmetrical, unless noted otherwise.

D. Circuit breakers shall be UL listed for application at 100% of their continuous ampere rating in their intended enclosure where specifically indicated on the plans.

E. Ground Fault Protection:

1. Furnish and install UL listed ground sensor relay system with ground break components for each of the protective devices indicated on the drawings. Each unit shall consist of a coordinated ground sensor with integral test winding, solid-state relay to operate the shunt trip circuit on the circuit protective device, and monitor/test panel. System shall be zero sequence type.

2. Where the overcurrent protection device for which ground fault has been specified includes integral current transformers necessary for phase overcurrent protection, the ground fault functionality may be provided by vector summation of the load current in the phase conductors and neutral conductor(s) (“differential current” or “residual current” method). In such instances, provide a neutral current transformer and associated wiring back to the ground fault relay.

3. The relays shall be of the standard time-delay type and have continuously adjustable current pickup settings of 100 to 1,200 amperes and continuously adjustable time-delay setting from instantaneous (0.03 second) to 1 second. The monitor panel shall indicate relay operation and provide means for testing the system with or without interruption of service, and must not permit the ground fault system to be inadvertently left in an inactive or OFF state.

4. Where noted on the one-lines, provide modified differential type (87B, 87G, etc.), arranged as described and depicted. Provide associated CTs to fully enclose the zone protected. CTs must coordinate with the 87B and 87G relay supplied.

F. Provide arc energy-reducing maintenance switch with local status indicator for each breaker rated 1,200 amps or higher.

2.3 ACCESSORIES

A. Provide shunt trips, bell alarms, and auxiliary contacts as shown or noted on the contract drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fuses:

1. Install fuses in such a manner as to expose manufacturer’s label indicating model number and ratings.

2. Legibly write the design fuse type on the inside of the switch cover with an indelible ink marker.

3. Coordinate installation location of the spare fuse cabinet with the Owner, and install prior to Project Closeout.

4. Fuses shall be provided in accordance with the Power System Study.

B. Circuit Breakers: Set adjustable circuit breakers in accordance with the Power System Study.

C. Ground Fault Protection: Set trip unit in accordance with the Power System Study.

3.2 OVERCURRENT SIZE VERIFICATION

A. Confirm maximum overcurrent protective device (MOCP) ratings with mechanical accepted shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust the supply circuit breaker and/or fuse ratings to match accepted shop drawing MOCP data per NEC 430, 440, and 695.

B. Where equipment includes an adjustable speed drive, upstream overcurrent device and feeder size shall be adjusted to match the rated input current to the accepted drive furnished. In no case shall the overcurrent setting be less than 125% of the nameplate load. Refer to the NEC and Division 23 specifications for requirements. Confirm accepted adjustable speed drives to be supplied PRIOR TO ORDERING related overcurrent device(s) and installing underground conduit.

C. Prior to project completion, the Contractor shall verify that MOCP ratings match nameplate data for installed equipment. Correct MOCP device sizes as required by NEC 430, 440, and 695.

3.3 TESTING

A. Switchboard and Circuit Breaker Testing: See Specification Section 26 05 00, General Provisions, Testing article.

B. Test functionality of arc energy-reducing maintenance switch in accordance with the manufacturer’s published literature. Verify that local status indicator is functional.

END OF SECTION

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SECTION 26 28 16

ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install enclosed “safety” switches and enclosed circuit breakers as shown on the drawings and as required by the NEC.

1.2 RELATED SECTIONS

A. Specification Section 26 05 53, Identification for Electrical Systems.

B. Specification Section 26 28 13, Overcurrent Protection.

1.3 ACTION SUBMITTALS

A. Submit product data indicating compliance with this specification for each type of enclosed switch and circuit breaker.

PART 2 - PRODUCTS

2.1 GENERAL

A. Basis of Design: Drawings are based on Square D. Subject to compliance with requirements, provide the basis of design product or comparable product acceptable to the Architect by one of the following:

1. ABB/General Electric.

2. Eaton.

3. Siemens.

4. Square D.

B. Switches and circuit breakers shall be mounted in a sheet metal enclosure with externally operable pad-lockable handles. Device mounting shall include an interlocking cover and suitable internal supporting members in the rear of the cabinet. Provide enclosure with an ANSI 61 finish, surface mount, except where shown recessed on the drawings. NEMA-1 for indoor applications, unless noted otherwise. All enclosures outside the building shall have a minimum of NEMA-3R ratings, unless noted otherwise.

2.2 SAFETY SWITCHES

A. Safety switches shall be heavy-duty type, externally operated with interlocking cover, quick-make, quick-break, rated 240 Volts or 600 Volts, as applicable, with the number of poles and ampacity as noted. All switches for motors shall be horsepower rated. All switches outside the building shall have NEMA-3R enclosures. Safety switches shall be fused, except where noted to be non-fused (NF) on the drawings or otherwise specified. Fusible switches shall be capable of accepting Class R rejection fuses, but shall be set up for the fuse class indicated on the drawings.

B. Disconnecting Means for Fractional Horsepower, 120-Volt, Single-Phase Motors:

1. With Built-In Thermal Overload Protection: Single-pole, manual motor starter with pilot light unless noted otherwise. Starter ampere rating shall match branch circuit breaker.

2. Without Built-In Thermal Overload Protection: Single-pole, manual motor starter with thermal overload protection and pilot light, unless noted otherwise. Starter ampere rating shall match branch circuit breaker. Overload elements shall be sized per motor manufacturer's recommendations and NEC Article 430.32. Maximum ambient temperatures shall be considered when sizing overload elements.

C. Disconnecting means for fractional horsepower motors larger than 1/2 horsepower, for integral horsepower motors, and for equipment of similar capacity shall be provided per this section.

D. Disconnecting means for small 120-Volt equipment 12 amps or less shall be specification grade, single-pole, 15-amp toggle switch with pilot light.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Provisions of Specification Section 26 28 13, Overcurrent Protection, shall apply.

B. Circuit Breakers: Circuit breakers shall be molded-case, trip-free, quick-make, quick-break, thermal-magnetic type, with handles clearly indicating rating and position - ON, OFF or TRIPPED. Where series combinations are noted to be applied on the plans, UL series combination ratings shall be maintained with upstream overcurrent device(s).

2.4 DISCONNECTING MEANS FOR VFDS

A. Where a local disconnecting means for an item of equipment is remotely located on the load side of a variable frequency drive (VFD), provide that local disconnecting means with a factory-installed electrical interlock kit. The interlock kit contact shall be wired into the VFD shutdown control to prevent damage to the VFD in the event the disconnecting means is operated while equipment is under load.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install safety switches and enclosed circuit breakers at locations indicated on the drawings, using approved fastening methods, and maintaining proper working clearances per NEC 110.26 and mounting parameters per NEC 404.

B. Where it is not possible to install safety switches and enclosed circuit breakers on a wall, structure or item of equipment, provide rigid, freestanding supports of galvanized angle or channel. Supports shall be primed and painted.

C. Safety Switches and Enclosed Circuit Breakers Upstream of VFDs: The shutdown interlock kit shall be field adjusted to insure the interlock contact operates before disconnecting means breaks the load contacts/switch blades.

D. Circuit Breakers: Set adjustable circuit breakers per the engineered coordination settings.

E. Ground Fault Protection: Set trip unit per the engineered coordination settings.

3.2 EQUIPMENT SIZE VERIFICATION

A. Confirm the rating of the disconnecting means with mechanical shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust minimum sizes provided based on nameplate data per NEC 430 and 440.

3.3 OVERCURRENT SIZE VERIFICATION

A. Confirm maximum overcurrent protective device (MOCP) ratings with accepted mechanical shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust the supply circuit breaker and/or fuse ratings to match accepted shop drawing MOCP data per NEC 430, 440, and 695.

B. Where equipment includes an adjustable speed drive, upstream overcurrent device and feeder size shall be adjusted to match the rated input current to the accepted drive furnished. In no case shall the overcurrent setting be less than 125% of the nameplate load. Refer to the NEC and Division 23 specifications for requirements. Confirm accepted adjustable speed drives to be supplied PRIOR TO ORDERING related overcurrent device(s) and installing underground conduit.

C. Prior to project completion, the Contractor shall verify that MOCP ratings match nameplate data for installed equipment. Correct MOCP device sizes as required by NEC 430, 440, and 695.

END OF SECTION

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SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the surge protection device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the Contract Drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the AC surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, or motor control centers.

1.2 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL Standard (ANSI/UL 1449 3rd Edition).

1.3 SUBMITTALS FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: Model number, SPD type, system voltage, phases, modes of protection, voltage protection rating (VPR), and nominal discharge current (In).

2. For side-mount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Descriptive bulletins.

2. Product sheets.

1.4 SUBMITTALS FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final As-Built Drawings and information for items listed in Specification Section 26 05 00, General Provisions, and shall incorporate all changes made during the manufacturing process.

1.5 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of 5 years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with the manufacturer's instructions. One copy of the manufacturer's instructions shall be included with the equipment at the time of shipment.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be provided with each SPD shipped.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. APT.

B. Eaton Cutler-Hammer.

C. Liebert.

D. Square D.

E. United Power.

F. As approved.

G. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer 10 days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage: Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 125% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes: The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a 20 kA In rating regardless of their SPD type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20 kA shall be rejected.

ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:			
Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1,200	1,500
L-L	1,200	2,000	3,000

B. SPD Design:

1. Maintenance-Free Design: The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

4. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low-impedance conductors.

5. Monitoring Diagnostics: Each SPD shall provide the following integral monitoring options:

   a. Protection Status Indicators: Each unit shall have a green/red solid-state indicator light that reports the status of the protection on each phase.

      1) For wye-configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye-configured units shall also contain an additional green/red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

      2) For delta-configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

      3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

   b. Remote Status Monitor: The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

   c. Audible Alarm and Silence Button: The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

   d. Surge Counter: The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 amps ± 20 amps occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

      1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter’s display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter’s memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection: The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements:

   a. The SPD shall minimize potential arc flash hazards by containing no user serviceable/replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

   b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

   c. Side-mount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Side-mount SPDs shall have factory-installed phase, neutral, ground, and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity: The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum Surge Current Capacity Based on ANSI/IEEE C62.41 Location Category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs)	120 kA	60 kA

C. SPD Type: All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

3. The panelboard shall be capable of re-energizing upon removal of the SPD.

4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30-amp circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30-amp circuit breaker.

5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

6. The SPD shall be of the same manufacturer as the panelboard.

7. The complete panelboard, including the SPD, shall be UL 67 listed.

B. Side-Mount Mounting Applications Installation (SPD Mounted External to Electrical Assembly): Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer’s recommended installation and wiring practices.

C. Switchgear, Switchboard, and MCC Requirements:

1. The SPD application covered under this section is for switchgear, switchboard, and MCC locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

2. The SPD shall be of the same manufacturer as the switchgear, switchboard, and MCC.

3. The SPD shall be factory installed inside the switchgear, switchboard, and MCC at the assembly point by the original equipment manufacturer.

4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

5. The SPD shall be connected through a disconnect (30-amp circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

6. The SPD shall be integral to switchgear, switchboard, and MCC as a factory-standardized design.

7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.5 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1: Constructed of a polymer (units integrated within electrical assemblies) or steel (side-mount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).

2. NEMA 4: Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure (side-mount units only).

3. NEMA 4X: Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection (side-mount units only).

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL Standards.

3.2 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.3 WARRANTY

A. The manufacturer shall provide a full 10-year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer’s written instructions and any applicable national or local code.

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING FIXTURES & LAMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all interior lighting fixtures with lamp assemblies as specified and as shown on the drawings. Lighting fixtures shall be complete, including canopies, hangers, reflectors, diffusers, drivers, etc.

1.2 ACTION SUBMITTALS

A. Provide a product-specific submittal for each lighting fixture type. Catalog cut sheets illustrating conformance with specifications will be acceptable for standard units. Drawings shall indicate materials, assembly, finish, and dimensions.

B. Photometric data shall be furnished for all lighting fixtures listed on the Lighting Fixture Schedule, and shall include the following:

1. Light engine output assembly type used in photometric tests.

2. Fixture candela curve with perpendicular and parallel sections.

C. LED (light-emitting diode) light engine and driver data matrix shall include the following:

1. LED light engine assembly type, wattage, dimensions, light engine color temperature in Kelvin, and Color Rendition Index for each type of lighting fixture.

2. Driver type, quantity per lighting fixture, wattage/amperage, voltage, switching criteria, and dimensions for each type of lighting fixture. Clearly indicate driver power factor, load (ma), and compliance to the specifications.

1.3 WARRANTY

A. LED lamps and drivers shall have a 24-month warranty. Lamps and drivers that fail during the initial 24-month warranty period will be replaced and installed at no cost to the Owner. Lamp failure is defined to be failure of more than 10% of the LEDs within the fixture for a specific distribution (up, down, etc.).

PART 2 - PRODUCTS

2.1 GENERAL

A. All catalog numbers are given for manufacturer’s identification and do not relieve the Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where conflicts occur, the most expensive option shall be enforced. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the specifications and matches the specified installation requirements.

B. All lighting fixtures of the same type shall be of one manufacturer and of identical finish and appearance.

C. All lighting fixtures and component parts shall bear the UL label.

D. All lamp assemblies installed within the same lighting fixture type shall be of the same manufacturer.

E. All drivers installed within the same lighting fixture type shall be of the same manufacturer.

F. Where intrusion protection (IP) ratings are specified, provide documentation indicating compliance.

G. Clearly indicate any deviations to dimensions of specified lighting fixture.

2.2 CONSTRUCTION

A. All steel parts shall be phosphate treated in multi-stage power spray system for corrosion resistance and paint adhesion. Standard final finish shall be electrostatically applied, baked white enamel of not less than 87% reflectance on reflecting surfaces. Refer to the Lighting Fixture Schedule and/or the drawings for other finish types.

B. Each recessed/flush-mounted lighting fixture shall have a continuous light-seal gasket seated in such a manner as to prevent any light leakage through any portion or around any edge of the trim frame.

C. Lenses/diffusers shall be framed in a hinged continuous assembly. Lens/diffuser frame latches shall be loaded or cam operated. Where noted on the drawings, provide tamper-resistant latches.

D. All lighting fixture sockets shall be securely fastened to the lighting fixture body to prevent movement during relamping.

E. For recessed lighting fixtures, provide a through-wiring junction box set to the side, where it shall be accessible when the lighting fixture reflector assembly is removed from the lighting fixture housing. Connect the box to the lighting fixture housing with flexible conduit. Clearly indicate when a lighting fixture requires above-soffit/ceiling access.

F. All recessed lighting fixtures shall be provided with frames appropriate for the type of soffit/ceiling involved. No lighting fixtures shall be submitted for review or ordered until the soffit/ceiling construction and mounting method have been verified by the Contractor.

G. The finish of all lighting fixtures is subject to final approval by the Architect and Engineer. Furnish paint chips to the Architect and Engineer for selection for all non-standard finishes. Color selection shall be reviewed by the Architect prior to the review of submittals by the Engineer.

H. All electrical requirements for lighting fixtures shall be verified with the drawings, catalog number, and Lighting Fixture Schedule prior to ordering.

I. The Contractor shall provide dimming and switching as indicated on the plans. The driver quantities shall be determined by the required switching criteria.

J. Fixture manufacturer will test and ensure compatibility of the system components including, but not limited to, light source (engine), luminaire, driver power supply, and control interface with added components as needed for a complete and functioning system.

2.3 DRIVERS

A. LED drivers shall be high power factor electronic type, NEMA 410 compliant. An audible noise rating of Class A shall be maintained. Driver and lamp combination shall match for optimum operational efficiency. Provide reverse polarity protection, open circuit protection requiring no minimum load. Provide 80% minimum efficiency. Manufactured by Advance, CREE, Osram Sylvania, Philips, or as accepted.

B. Provide LED Dimming: Provide system capable of full range continuous dimming, 0 to 10-volt control.

C. Drivers shall be CBM certified, bear the UL label, and have a sound rating of "A."

D. Driver shall be modular in design, readily available as a replacement component, designed to be removable and replaceable from within a fixture. Driver shall not be integral to the light engine circuit board.

E. Lighting fixtures located within low temperature, damp, and wet environments shall have drivers designed for proper operation.

F. The Contractor shall be responsible for the replacement of drivers due to excessive noise or failure within the project warranty period.

2.4 LENSES/DIFFUSERS/LOUVERS/REFLECTORS

A. Lenses/diffusers shall be furnished as indicated on the drawings.

B. Lenses/diffusers shall be 100% virgin acrylic with a minimum thickness of 1/8 inch (0.125 inch), Pattern A19, unless noted otherwise on the drawings.

C. No lens/diffuser shall be manufactured with polystyrene, copolymer (mixture of polystyrene and acrylic), or reclaimed or recycled acrylic plastic.

D. All parabolic louvers and open reflectors shall be shipped with a protective plastic covering or coating. The protective covering shall not be removed until all construction is complete and final lighting fixture assembly is complete. The Contractor shall be responsible for cleaning all louver assemblies; in particular, removing all smudges, fingerprints, dust particles, etc.

E. All reflector or louver striations deemed unacceptable by the Engineer shall be replaced prior to project closeout.

F. Align lenses/diffusers/louvers/reflectors for all lighting fixtures in a like manner, unless noted otherwise.

G. Clean luminaire reflector systems, lenses, and enclosures after all construction dust has been removed from the area.

2.5 SUPPORT

A. Surface- or pendant-mounted lighting fixtures shall be supported as follows:

1. From the outlet box by means of a metal strap, where its weight is less than 5 pounds.

2. From its outlet box by means of a hickey or other threaded connection, where its weight is from 5 to 50 pounds.

B. Lighting fixtures shall be supported independently of the ceiling system or additional ceiling suspension must be added to support the weight of the lighting fixtures. It is the responsibility of the Electrical Contractor to coordinate all support requirements with the ceiling system installer. Recessed lighting fixtures supported from ceiling grid tee systems shall be furnished with hold-down clips in conformance with NEC 410.36.

C. Furnish and install supplementary blocking and support as required to support lighting fixtures from structural members. This blocking may include multiple members and shall be coordinated with the Structural Engineer prior to rough-in.

D. Suspended lighting fixtures shall be stem mounted and shall be free to swing 20 degrees in any direction. Ceiling swivels shall be of the ball-aligner type.

E. Chain suspension may be used only where specifically permitted on the drawings. Chain shall be heavy-duty, nickel- or cadmium-plated, suitable for weight of specific lighting fixture. Lighting fixtures installed in rows, continuous or spaced apart, shall be attached to a unistrut-type backbone. This backbone shall align all lighting fixtures true, straight, and level. Where chain suspension is not allowed, provide 1/4-inch-diameter, all-thread nickel- or cadmium-plated rod.

F. All supports, where not concealed, shall be painted. Coordinate paint requirements with the Architect.

2.6 LAMPS

A. LED Light Engines:

1. LED light engines shall provide illumination with CRI greater than 80.

2. LED light engines shall comply with ANSI chromaticity standard for classifications of color temperature. Reference Luminaire Schedule for specified LED lamp color and color temperature. LED light engines shall be UL or ETL listed and labeled.

3. LED light engines shall be luminaire tested per IESNA LM-79 and LM-80 requirements.

a. Lamp Life for White LEDs: 100,000+ hours with lamp failure occurring when LED produces 70% of initial rated lumens.

b. Lamp Life for Color LEDs: 50,000+ hours with lamp failure occurring when LED produces 50% of initial rated lumens.

4. LED Light Source Manufacturers: CREE, GE Lighting, Nichia, Osram Sylvania, Philips, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures installed in rows shall be aligned. For square trims, the flat sides shall be aligned to other fixtures in the row; or where individually mounted, aligned with the surrounding walls.

B. Pendant fixtures shall be installed level, unless otherwise noted. Pendant fixtures occurring in rows shall be vertically and horizontally aligned.

C. Protective films or covers shall be provided for each fixture to prevent dust and debris contamination of the fixture interior. These covers shall remain in place until substantial completion.

D. Cleaning of reflectors shall be performed as recommended by the manufacturer. At minimum, protective gloves shall be worn to prevent body oils from contacting the reflector.

3.2 LIGHTING FIXTURE OPERATION

A. Test for proper operation of all lighting fixtures, including control requirements for each. This may include line-voltage or low-voltage switching and/or dimming requirements.

END OF SECTION

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SECTION 26 52 00

EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all interior and exterior emergency unit equipment, emergency exit signage, and emergency battery packs (EBPs) as specified and as shown on the drawings. Units shall be complete, including remote mounting, test switches, etc.

1.2 ACTION SUBMITTALS

A. Provide a product-specific submittal for each different item. Identify use within each lighting fixture type or as a standalone unit as specified. Catalog cuts illustrating conformance with specifications will be acceptable for standard units. Drawings shall indicate materials, assembly, finish, and dimensions.

B. Provide mounting coordination for EBP equipment installed within the specified lighting fixture prior to submitting the units for review.

C. Illumination data shall be furnished for lighting fixtures with integral or remote-mounted EBPs, and for unit equipment per the Lighting Fixture Schedule. Data shall include the following:

1. Unit Equipment and Emergency Exit Signage:

a. Rated voltage and wattage output at the end of the 90-minute period of operation.

b. Battery type and temperature limitations.

c. Listed lamp operational matrix marked with the specified lamp.

d. Specified and supplied lamp candela curve with perpendicular and parallel sections.

e. Overall dimensions of the complete assembly.

f. Table of equipment for remote lamp wire size recommendations based on length.

2. Emergency Battery Packs:

a. Fixture cut sheet indicating the rated lumen output at the end of the 90-minute period of operation.

b. Battery type and temperature limitations.

1.3 WARRANTY

A. LED lamps and drivers shall have a 24-month warranty. Lamps and drivers that fail during the initial 24-month warranty period will be replaced and installed at no cost to the Owner. LED lamp failure is defined as a failure of 10% of the LED chips on any one LED module (array or grouping on a single PC board).

B. Emergency batteries shall have a 60-month warranty against battery failure.

PART 2 - PRODUCTS

2.1 GENERAL

A. All catalog numbers are given for manufacturer's identification and do not relieve the Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where conflicts occur, the most expensive option shall be enforced. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the specifications and matches specified ceiling.

B. Equipment shall be listed for use on emergency systems and bear the confirming UL label, UL 924.

C. All steel parts shall be phosphate treated in multi-stage power spray system for corrosion resistance and paint adhesion. Standard final finish shall be electrostatically applied, baked enamel.

D. Batteries shall be maintenance-free nickel-cadmium type. Battery charger shall be designed to maintain batteries at full output capacity.

E. Fixtures located within low temperature, damp, and wet environments shall have ballasts designed for proper operation within the installed environment.

F. The Contractor shall be responsible for the replacement of all ballasts due to excessive noise or failure for 1 year after final acceptance.

2.2 UNIT EQUIPMENT AND EMERGENCY EXIT SIGNAGE

A. Electronics section shall include:

1. Brownout protection.

2. Current-limiting charger to maximize battery life and minimize energy consumption.

3. Short-Circuit Protection: Current-limiting charger circuitry and fused output circuit to protect printed circuit board from shorts.

4. Thermal protection to sense circuitry temperature and adjust charge current to prevent overheating and charger failure.

5. Thermal compensation to adjust charger output to provide optimum charge voltage relative to ambient temperature.

6. Regulated charge voltage to maintain constant-charge voltage over a wide range of line voltages and to prevent over/under charging that shortens battery life and reduces capacity.

7. Filtered charger output to minimize charge voltage ripple and extend battery life.

B. Self-diagnostic circuitry shall be provided where specified. Functionality shall include:

1. Single multi-chromatic LED indicator to display charging state, test activation, and diagnostic status.

2. Test switch, manual or magnetic, shall provide manual activation of 30-second diagnostic testing for on-demand visual inspection.

3. Self-diagnostic testing shall occur for 5 minutes every 30 days and 30 minutes every 6 months. Diagnostic evaluation shall include lamp, AC to DC transfer, charging, and battery condition.

4. Automatic test postponement for up to 8 hours by activating manual test switch.

5. Load-learning component shall self-calibrate to DC load at first test, enabling it to detect a lamp failure on future tests. Simple functionality shall be provided for recalibration at any time.

C. Equipment housing shall include a test pushbutton and a charger failure-indicating lamp.

D. Lamp heads shall be as scheduled. Where not indicated, provide halogen-type sealed beam.

2.3 EMERGENCY BATTERY PACKS (EBP)

A. EBPs for LED lamps shall be provided for egress lighting fixtures when indicated on the Lighting Fixture Schedule or on the floor plans. EBPs shall illuminate LEDs to a lumen level indicated on the Lighting Fixture Schedule for 90 minutes per UL, NFPA, NEC, and OSHA Standards. All EBPs shall allow for normal switched operation with automatic switching to emergency (battery) operation upon loss of AC power. EBPs shall be installed by the fixture manufacturer. Batteries shall be NiCad or nickel metal hydride. The indication on the drawings for an “EBP” is not for night-light continuous illumination, unless otherwise specified. Pilot light and test switch shall be accessible from below fixture location and remote mount at wall where fixtures are cove mounted. Lumen output shall be provided as scheduled.

2.4 SUPPORT

A. Surface-mounted fixtures shall be supported as follows:

1. From the outlet box by means of a metal strap, where its weight is less than 5 pounds.

2. From the outlet box by means of a hickey or other threaded connection, where its weight is from 5 to 50 pounds.

B. Where remotely mounted, EBPs shall be supported independently of the ceiling system or additional ceiling suspension must be added to support the weight of the lighting fixtures. It is the responsibility of the Electrical Contractor to coordinate all support requirements with the ceiling system installer.

C. Furnish and install supplementary blocking and support as required to support fixtures from structural members. This blocking may include multiple members and shall be coordinated with the Structural Engineer prior to rough-in.

D. All supports, where not concealed, shall be painted. Coordinate paint requirements with the Architect.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide continuous (unswitched) power source to unit equipment and to each EBP. Do not wire fixtures containing an EBP as a default night-light, unless specified.

B. Remote mount test switch to accessible position in wall or ceiling for remotely mounted emergency ballasts. Location shall be accessible from no more than a 6-foot ladder. Provide label as to area served.

C. Upon completion of the project, initiate unit equipment self-diagnostic function manual test to reset memory.

3.2 BATTERIES

A. Where emergency egress lighting fixtures are located at the exterior or in high ambient temperature environments, provide a remote battery assembly within the building interior and/or in a temperature environment suitable for the battery unit based on the equipment manufacturer recommendations to maintain the design battery life.

3.3 LIGHTING FIXTURE OPERATION

A. Test for proper operation of unit equipment and lighting fixtures containing emergency ballasts or emergency carryover ballasts, including control requirements for each. This may include local switching, low-voltage switching, and/or dimming requirements. Verify that emergency ballasts or emergency carryover ballasts have not been wired as default night-lights, unless specified.

END OF SECTION

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SECTION 26 56 00

EXTERIOR LIGHTING FIXTURES & LAMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all exterior lighting fixtures with lamps as specified and as shown on the drawings. Lighting fixtures shall be complete, including poles, bases, canopies, hangers, diffusers, drivers, etc.

1.2 ACTION SUBMITTALS

A. Provide a product-specific submittal for each lighting fixture type. Catalog cut sheets illustrating conformance with specifications will be acceptable for standard units. Drawings shall indicate materials, assembly, finish, and dimensions.

B. Photometric data shall be furnished for all lighting fixtures listed on the Lighting Fixture Schedule, and shall include the following:

1. A computer-generated printout for exterior spaces. Obtain design data and generate a computer model for review by the Engineer. No maintenance factor shall be applied unless specifically noted otherwise. Provide horizontal footcandles on a 10-foot on center grid dimension and at 0 inch above finish floor (AFF), except for sports lighting, which shall be at 30 inches AFF.
2. Lamp type used in photometric tests.
3. Lamp candela curve with perpendicular and parallel sections.

C. LED (light emitting diode) light engine and driver data matrix shall include the following:

1. LED light engine assembly type, wattage, dimensions, light engine color temperature in Kelvin, and Color Rendition Index for each type of lighting fixture.
2. Driver type, quantity per lighting fixture, wattage/amperage, voltage, switching criteria, and dimensions for each type of lighting fixture. Clearly indicate driver power factor, load (ma), and compliance to the specifications.

1.3 WARRANTY

A. LED lamps and drivers shall have a 24-month warranty. Lamps and drivers that fail during the initial 24-month warranty period will be replaced and installed at no cost to the Owner. Lamp failure is defined to be failure of more than 10% of the LEDs within the fixture for a specific distribution (up, down, etc.).

PART 2 - PRODUCTS

2.1 GENERAL

A. All catalog numbers are given for manufacturer's identification and do not relieve the Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where conflicts occur, the most expensive option shall be enforced. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the specifications and matches specified installation requirements.

B. All lighting fixtures of the same type shall be of one manufacturer and of identical finish and appearance.

C. All lighting fixtures and component parts shall bear the UL label.

D. All lamps installed within the same lighting fixture type shall be of the same manufacturer.

E. All drivers installed within the same lighting fixture type shall be of the same manufacturer.

F. Where intrusion protection (IP) ratings are specified, provide documentation indicating compliance.

G. Clearly indicate any deviations to dimensions of specified lighting fixture.

2.2 CONSTRUCTION

A. Each recessed/flush-mounted lighting fixture shall have a continuous light-seal gasket seated in such a manner as to prevent any light leakage through any portion or around any edge of the trim frame.

B. Lenses/diffusers shall be framed in a hinged continuous assembly. Lens/diffuser frame latches shall be loaded or cam operated. Where noted on the drawings, provide tamper-resistant latches and/or fasteners.

C. All lighting fixture sockets shall be securely fastened to the lighting fixture body to prevent movement during relamping.

D. For recessed lighting fixtures, provide a through-wiring junction box set to the side, where it shall be accessible when the lighting fixture reflector assembly is removed from the lighting fixture housing. Connect the box to the lighting fixture housing with flexible conduit. Clearly indicate when a lighting fixture requires above-soffit/ceiling access.

E. All recessed lighting fixtures shall be provided with frames appropriate for the type of soffit/ceiling involved. No lighting fixtures shall be submitted for review or ordered until the soffit/ceiling construction and mounting method have been verified by the Contractor.

F. The finish of all lighting fixtures and associated assemblies is subject to final approval by the Architect and Engineer. Furnish paint chips to the Architect and Engineer for selection for all non-standard finishes. Color selection shall be reviewed by the Architect prior to the review of submittals by the Engineer.

G. All electrical requirements for lighting fixtures shall be verified with the drawings, catalog number, and Lighting Fixture Schedule prior to ordering.

H. Fixture manufacturer will test and ensure compatibility of the system components, including, but not limited to, light source (engine), luminaire, driver power supply, and control interface with added components as needed for a complete and functioning system.

2.3 DRIVERS

A. LED drivers shall be high power factor electronic type, NEMA 410 compliant. An audible noise rating of Class A shall be maintained. Driver and lamp combination shall match for optimum operational efficiency. Provide reverse polarity protection, open circuit protection requiring no minimum load. Provide 80% minimum efficiency. Manufactured by Advance, CREE, Osram Sylvania, Philips, or as accepted.

B. Drivers shall be CBM certified, bear the UL label, and have a sound rating of "A."

C. Driver shall be modular in design, readily available as a replacement component, designed to be removable and replaceable from within a fixture. Driver shall not be integral to the light engine circuit board.

D. Lighting fixtures shall have drivers designed for 0°F (-17.7°C) operation.

E. The Contractor shall be responsible for the replacement of drivers due to excessive noise or failure within the project warranty period.

2.4 LENSES / DIFFUSERS / LOUVERS / REFLECTORS

A. Lenses/diffusers shall be furnished as indicated on the drawings.

B. No lens/diffuser shall be manufactured with polystyrene, copolymer (mixture of polystyrene and acrylic), or reclaimed or recycled acrylic plastic.

C. All reflector or louver striations deemed unacceptable by the Engineer shall be replaced prior to project closeout.

D. Align lenses/diffusers/louvers/reflectors for all lighting fixtures in a like manner, unless noted otherwise.

E. Clean luminaire reflector systems, lenses, and enclosures prior to project closeout.

2.5 SUPPORT

A. Furnish and install supplementary blocking and support as required to support lighting fixtures from structural members. This blocking may include multiple members and shall be coordinated with the Structural Engineer prior to rough-in.

B. Suspended lighting fixtures shall be stem-mounted and shall be free to swing 20 degrees in any direction. Ceiling swivels shall be of the ball-aligner type.

C. All supports, where not concealed, shall be painted. Coordinate paint requirements with the Architect.

D. Pole assemblies shall be designed by a Structural Engineer with specific Effective Projected Area (EPA) of the lighting fixture(s) on each pole taken into account. This shall include, but not be limited to, the pole assembly base design. Provide a base design, including anchor bolts, steel cage components, concrete strength, surface finish, and overall formed dimensions. Coordinate these requirements with pole assembly detail(s) on the drawings. Coordinate the base design with prevailing local soil conditions. Obtain the project soils report prior to design of the base information. Where a soils report is not available, obtain a soils report for the specific base locations for the project.

E. Where curb protection is not available, provide concrete base height protection from vehicles in parking or driveway areas at a minimum of 30 inches above finish grade (AFG), unless noted otherwise. Where curb protection is available, provide a minimum of 6 inches AFG at non-walkway areas. Provide flush base mounting at pedestrian walkways with bolt cover being the only item above grade. Fully coordinate the top of the base to be flush with the surrounding surface.

2.6 LAMPS

A. LED Light Engines:

1. LED light engines shall provide illumination with CRI greater than 80.
2. LED light engines shall comply with ANSI chromaticity standard for classifications of color temperature. Reference the Luminaire Schedule for specified LED lamp color and color temperature. LED light engines shall be UL or ETL listed and labeled.
3. LED light engines shall be luminaire tested per IESNA LM-79 and LM-80 requirements.

    a. Lamp Life for White LEDs: 100,000+ hours with lamp failure occurring when LED produces 70% of initial rated lumens.
    b. Lamp Life for Color LEDs: 50,000+ hours with lamp failure occurring when LED produces 50% of initial rated lumens.

4. LED Light Source Manufacturers: CREE, GE Lighting, Nichia, Osram Sylvania, Philips, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures installed in rows shall be aligned. For square trims, the flat sides shall be aligned to other fixtures in the row, or where individually mounted, aligned with the surrounding walls.

B. Pendant fixtures shall be installed level, unless otherwise noted. Pendant fixtures occurring in rows shall be vertically and horizontally aligned.

C. Protective films or covers shall be provided for each fixture to prevent dust and debris contamination of the fixture interior. These covers shall remain in place until substantial completion.

D. Cleaning of reflectors shall be performed as recommended by the manufacturer. At minimum, protective gloves shall be worn to prevent body oils from contacting the reflector.

3.2 SITE LIGHTING OPTICS

A. Rotate optics as required to obtain proper coverage. Where mounting or optical pattern is unclear, submit questionable cases to the Architect for clarification at least 2 weeks in advance of installation.

3.3 LIGHTING FIXTURE OPERATION

A. Test for proper operation of all lighting fixtures, including control requirements for each. This may include line-voltage or low-voltage switching requirements.

END OF SECTION

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DIVISION 28

ELECTRONIC SAFETY & SECURITY

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SECTION 28 46 00

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SCOPE

A. This specification provides the requirements for the installation, programming, and configuration of a complete addressable intelligent life safety system network for the Fort Apache Boys Dormitory Rehabilitation. The system shall include, but not be limited to: Fire alarm control panel(s), automatic and manually activated voice evacuation alarm subsystem with firefighter telephone communications, automatic and manually activated alarm initiating and indicating peripheral devices and appliances, conduit, wire and accessories required to furnish a complete and operational life safety system as shown on the drawings, as specified, and as directed by the Architect/Engineer.

B. The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.

C. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire alarm and detection operations.

2. Remote manual and automatic control of elevators, all smoke control related fan system, door hold-open devices, fire suppression appliances, remote monitoring of sprinkler, fire pump and emergency power systems, and/or off premise notification.

1.2 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:

1. Specification Section 21 05 20, Electrical & Control Wiring for Fire Suppression Systems.

1.3 ALTERNATES

A. Alternates/Alternatives to any of the product or work specified in this document will be allowed only if the substitution is recognized by the various listing agencies as compatible.

1.4 REFERENCES

A. The equipment and installation shall comply with the current provisions of the following standards:

1. National Electric Code, Article 760.

2. National Fire Protection Association Standards:

a. NFPA 72 - National Fire Alarm Code.

b. NFPA 101 - Life Safety Code.

3. Local and State Building Codes.

4. Local Authorities Having Jurisdiction (AHJ).

5. Underwriters Laboratories Inc.: The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:

   a. UL 864/UOJZ, APOU - Control Units for Fire Protective Signaling Systems.

   b. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.

   c. UL 217 - Smoke Detectors Single Station.

   d. UL 521 - Heat Detectors for Fire Protective Signaling Systems.

   e. UL 228 - Door Holders for Fire Protective Signaling Systems.

   f. UL 464 - Audible Signaling Appliances.

   g. UL 1638 - Visual Signaling Appliances.

   h. UL 38 - Manually Activated Signaling Boxes.

   i. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.

   j. UL 1971 - Standard for Signaling Devices for the Hearing Impaired.

   k. UL 1481 - Power Supplies for Fire Protective Signaling Systems.

   l. UL 1711 - Amplifiers for Fire Protective Signaling Systems.

6. Americans with Disabilities Act (ADA).

7. International Standards Organization (ISO): ISO-9000, ISO-9001.

1.5 SYSTEM DESCRIPTION

A. The fire alarm/life safety system supplied under this specification shall be a microprocessor-based network system. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as compatible to ensure that a fully functioning life safety system is designed and installed.

1.6 SUBMITTALS

A. Product Data:

1. The Contractor shall submit three complete sets of documentation within 30 calendar days after award of purchase order. Indicated in the documentation will be the type, size, rating, style, catalog number, manufacturer’s name, photos, and/or catalog data sheets for all items proposed to meet these specifications.

2. The proposed equipment shall be subject to the approval of the Architect/Engineer and no equipment shall be ordered or installed on the premises without that approval.

3. The Contractor shall provide hourly service rates and semi-annual inspection prices, performed by factory-trained and -authorized personnel, for this installed life safety system with the submittal. Proof of that training and authorization of the servicing Engineered Systems Distributor (ESD) shall be included in the submittal. These hourly service rates shall be guaranteed for a 2-year period unless otherwise specified.

B. Shop Drawings: A complete set of shop drawings, one for each unit subassembly which requires that a field wire be connected to it, shall be supplied. The shop drawings shall be reproduced electronically from a master copy supplied by the manufacturer in digital format.

C. Samples: Two samples of each field-connected device (smoke detectors, intelligent modules, horn, strobes, and/or speakers) shall be provided to the Contractor for their familiarization.

D. Closeout Submittals: Two copies of the following manual shall be delivered to the Building Owner's representative at the time of system acceptance. The closeout submittals shall include:

1. Operating Manuals covering the installed life safety system.

2. Point-to-point diagrams of the entire life safety system as installed. This shall include all connected smoke detectors and addressable field modules. All drawings shall be provided in CAD and supplied in standard .DXF format. Vellum plots of each sheet shall also be provided. A system-generated point-to-point diagram is required to ensure accuracy.

3. The application program listing for the system as installed at the time of acceptance by the Building Owner and/or local AHJ (disk and hard copy printout).

4. Name, address, and telephone of the factory-authorized representative.

5. All drawings must reflect device address and programmed characteristics as verified in the presence of the Engineer and/or the end user unless device addressing is electronically generated, and graphically printed.

1.7 QUALITY ASSURANCE

A. Qualifications: The installing ESD shall provide proof of their qualifications as factory-authorization and factory-training providers for the product(s) specified herein. These qualification credentials shall not be more than 2 years old, to ensure up-to-date product and application knowledge on the part of the installing ESD.

B. Warranty:

1. Warranty all materials, installation, and workmanship for 3 years from date of acceptance, unless otherwise specified.

2. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the Operation & Installation Manuals.

1.8 SYSTEM STARTUP, OWNER'S INSTRUCTIONS, COMMISSIONING SYSTEM

A. Startup shall be performed by a factory-trained and -authorized ESD.

B. Certain functions of the system startup procedure may be performed by a Contractor under the direction of the factory-trained and -authorized ESD.

C. Owner's Instruction & Operation Manuals, specific for this project, shall be supplied to the building operations staff by the factory-trained and -authorized ESD. A "generic" or "typical" Owner's Instruction & Operation Manual shall not be acceptable to fulfill this requirement.

D. Commissioning of the installed system shall be performed by the factory-trained and -authorized ESD in the presence of the local AHJ, the Building Owner's representative, and a representative of the General Contractor, if deemed appropriate.

E. A system-generated device map, which will serve as an "as-built" drawing, shall be provided to the local AHJ and the Building Owner's representative.

1.9 MAINTENANCE

A. The factory-trained and -authorized ESD who designed and installed this system shall provide a separate maintenance contract for a period of 5 years from the date of system commissioning.

PART 2 - PRODUCTS

2.1 GENERAL

A. This life safety system specification must be conformed to in its entirety to ensure that the installed and programmed life safety system will accommodate all of the future requirements and operations required by the Building Owner. Any specified item or operational feature not specifically addressed prior to bid date will be required to be met without exception.

B. Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all of the following requirements have been met:

1. Any deviation from the equipment, operations, methods, design, or other criteria specified herein must be submitted in detail to the specifying Architect or Engineer a minimum of 10 working days prior to the scheduled submission of bids. Each deviation from the operation detailed in these specifications must be documented in detail, including page number and section number that list the system function for which the substitution is being proposed.

2. A complete list of such substituted products, with three copies of working drawings for each, shall be submitted to and be approved by the Architect and/or Consulting Engineer, not less than 10 calendar days prior to the scheduled date for opening bids.

3. The Contractor or substitute bidder shall functionally demonstrate that the proposed substituted products are, in fact, equal in quality and performance to those specified herein. Because the decision to specify the life safety system(s) and equipment detailed herein was made by an Architect and/or Consulting Engineer on behalf of their client(s) (the Building Owners), such evidence of the applicability of any substitute materials must be submitted to, and accepted by, the Architect and/or Consulting Engineer, not less than 10 calendar days prior to the scheduled date for opening bids for this project. Substitute equipment will be accepted only on the discretion of the Architect and/or Consulting Engineer on behalf of the Building Owner.

2.2 EQUIPMENT AND MATERIAL GENERAL REQUIREMENTS

A. All equipment furnished for this project shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on Contract Drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be recognized as compatible by both manufacturers, and “listed” as such by UL.

B. System installation and operations shall be verified by the manufacturer’s representative and a verification certificate presented upon completion. The manufacturer’s representative shall be responsible for an onsite demonstration of the operation of the system and initial staff training as required by the Architect and/or Consulting Engineer.

C. The system shall be capable of detecting the electrical location of each signature intelligent device, including new and existing devices. It shall be possible to display the intelligent device map on the laptop PC.

D. If a device map cannot be generated by the control panel, the Contractor must include a minimum of 3 days to verify location of all wire runs while in the presence of the Architect/Engineer or Building Owner’s representative to verify all conduit and wire runs.

E. In addition, “as-built” riser and wiring diagrams reflecting all T-taps, each programmed device characteristic, including detector type, base type, serial number, sensitivity setting, and wire configurations, will be provided to the Architect/Engineer, based on the information gathered during the verification process described above.

F. It shall be possible for authorized service personnel using a program/service tool or laptop PC to change the personality/function of a Signature Series device to meet changes in building layout or environment. System changes shall be verified by the manufacturer’s representative and a verification certificate presented upon completion.

2.3 MANUFACTURERS

A. Equipment and materials shall be provided by Climatec Automation & Building Services, 602-944-3330, to ensure proper specification adherence, final connection, test, turnover, warranty compliance, and service.

B. Service Availability: The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

C. The ESD of the fire alarm/life safety equipment specified herein shall provide a copy of their certificate of successful completion of an authorized training course given by the manufacturer of the fire alarm/life safety equipment.

2.4 EQUIPMENT

A. The life safety system shall be a multiprocessor-based network system designed specifically for fire, audio evacuation, and security applications. The life safety system shall be an Edwards Systems Technology (EST) Model EST3, and shall be listed under UL 864 (Control Units for Fire-Protective Signaling Systems) under Categories UOJZ and APOU, and ULC Listed under CAN/ULC S527. The specified modules shall also be listed under UL 1076 (Proprietary Burglar Alarm Units and Systems) under Category APOU.

B. The life safety system shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:

1. Modular system design, with a layered application design concept, including an “operational layer” and a “human interface layer,” to allow maximum flexibility of the system with a minimum physical size requirement.

2. All system operational software is to be stored in FLASH memory. Control panel disassembly, and replacement of electronic components of any kind shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes.

3. Up to 128 service groups must be definable within the system program to allow the testing of the installed system based on the physical layout of the system, not on the wiring of the field circuits connected to the fire alarm control panel.

4. Advanced Windows-based system definition utility with program version reporting to document any and all changes made during system startup or system commissioning. Time and date stamps of all modifications made to the program must be included to allow full retention of all previous program version data.

5. System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.

6. One amplifier shall be supplied per speaker circuit to enhance system survivability.

7. HVAC status LED illumination shall be controlled by the activation of the output device. A “flash,” followed by a “steady” illumination will verify operation without the need for a “sail” switch in each air handling unit.

8. System common control functions shall be automatically routed to any node of the system as a function of the time of day and date.

2.5 THE LIFE SAFETY SYSTEM

A. Life Safety System Mechanical and Overall Feature Summary: The life safety system shall include the following features and shall support the following operations in each installed cabinet or node of the system:

1. Up to 10 Signature Series intelligent device loops.

2. Up to 125 intelligent smoke detectors and 125 intelligent modules per signature device card (SDC).

3. Up to 120 hard-wired input/output circuits.

4. Up to 342 manual control (input) switches.

5. Up to 456 LED annunciation points.

6. Up to 63 remote display units.

7. Multipriority, token-passing, peer-to-peer network connection of up to 64 system nodes wired as Class A (Style 7).

8. Ground fault detection by panel, by signature data circuit, and by device module.

9. Ability to download all system applications programs and “firmware” from a computer through a single point in the system.

10. True distributed intelligence, including microprocessor-based detectors and modules.

11. AC power trouble delay adjustable from 4 hours to 10 hours.

12. Removable, interlocked terminal blocks for the connection of the field wiring to the fire alarm control panel.

13. Electronic addressing of field devices.

14. Advanced power management.

15. Dead-front construction.

B. Life Safety System Human Interface System Common Controls and Emergency User Interface:

1. The fire alarm/life safety system shall include an emergency operator interface panel that shall include the following system annunciation and control functions:

2. System Annunciation and Control Functions:

a. Hands-Free Emergency Operation: The first and last highest-priority event on the system shall be displayed automatically and simultaneously.

b. Control panel internal audible signal shall have four programmable signal patterns to allow for the easy differentiation between Alarm, Supervisory, Trouble, and Monitor conditions within the installed system.

3. Five Discreet “System Status” LEDs:

   a. Power Status LED: Green LED shall illuminate when AC power is present.

   b. Test Status LED: Yellow LED shall illuminate when any portion of the system is in the Test mode. A programmable timer shall cause the system to automatically exit the Test mode after a period of system inactivity. This test LED shall function in either a Local or Group mode.

   c. CPU Fail Status LED: Yellow LED shall illuminate when the panel controller has an internal failure.

   d. Ground Fault Status LED: Yellow LED shall illuminate when ungrounded wiring connected to the cabinet’s power supply has continuity to ground. This feature shall function in either a Local or Group mode.

   e. Disable Status LED: Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.

4. Four Discreet Common Control Switches with Associated Status LEDs:

   a. Reset: Depression of the reset switch starts the system reset operation. The associated yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power-down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to Normal mode. Each phase, as well as the overall reset cycle, shall be programmable to perform other functions.

   b. Alarm Silence: Depression of the alarm silence switch shall turn off all (audible and/or visible) notification appliance circuits. The associated yellow LED illuminates when the Alarm Silence function is active, whether by the alarm silence switch, or by an integral software timer. Subsequent activation of the alarm silence switch shall re-sound the signals. Activation of the alarm silence switch shall be programmable to perform other functions.

   c. Panel Silence: Depression of the panel silence switch shall turn off the system’s internal audible signal when configured as a “local” system. The associated yellow LED illuminates when the panel silence feature is activated.

   d. Drill Switch/LED: Depressing the drill switch activates the Fire Drill function. Yellow LED indicates that the Fire Drill function is active. The drill switch shall also be programmable to perform system functions other than the Fire Drill function.

5. Other Operator Control Switches:

   a. Previous Message Switch: Pressing the Previous Message switch shall scroll the display to show the preceding message in the selected queue. Holding the Previous Message switch and pressing any queue select switch moves to the top of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

b. Next Message Switch: Pressing the Next Message switch shall scroll the display to show the following message in the selected queue. Holding the Previous Message switch and pressing any queue select switch moves to the bottom of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

c. More Details Switch: Pressing the More Details switch shall show the address and 42-character location message of the active device on display. If a zone is active, pressing the switch displays the address and message of active devices within the zone. When multiple devices are active, the Previous/Next Message switch may be used to scroll through the messages.

6. The System Main Liquid Crystal Display (LCD): The LCD shall provide the means to inform the system operator with detailed information about the off-normal status of the installed fire alarm/life safety system. The main display shall automatically respond to the status of the system, and shall display that status on an 8-line by 21-character backlit alphanumeric graphical LCD.

7. Automatic Functions: The following status functions shall be annunciated by the main LCD:

a. When the fire alarm/life safety system is in the Normal mode, the LCD displays:

1) The current date and time.

2) A custom system title (2 lines, 21 characters).

3) A summary total of the alarm history of the system.

b. With the fire alarm life safety system in the Alarm mode, the LCD shall automatically reconfigure into four logical windows.

1) Systems Status Window: The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD display.

2) Current Event Window: The LCD shall show the first active event of the highest priority in reverse text to highlight the condition to the emergency operator. The top line of the reverse text shall show the sequence number in which the displayed event was received, as well as its event type. The second and third lines of reverse text shall display an identification message related to the displayed event.

3) Last Event Window: The LCD shall show the most recent, highest-priority event received by the system.

4) Type Status Window: The LCD shall show the total number of active events in the system, by event type. There shall be four different system event types that shall be displayed: “Alarm Events,” “Supervisory Events,” “Active Trouble Events,” and “Active Monitor Events.”

8. System Message Processing: In order to simplify, and to clarify the system status information that is given to the emergency operator, the main LCD shall include queues for each of the system event types. The main LCD shall allow the emergency operator access to the system status information contained within those queues by pressing an associated queue select switch. Whenever there is an unacknowledged event in any of the system event queues, the associated status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue, and shall cause the associated LED to illuminate steady. All messages contained in any of the system event queues shall be accessible for review by the emergency operator using the Previous/Next Message switch. It shall be possible to route additional event information to a printer.

9. Maintenance Menu: The main LCD shall also allow the system operator to access system maintenance functions through a 4-level password system. The authorized system operator shall be able to access the following functions:

    a. System Status: The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.

    b. Enable: The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any Group function, Guard Patrol function, panel, system module, “software - defined zone,” Operator Control, or Time Control function.

    c. Disable: The system shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system. Additionally, the system shall allow the operator to disable any Group function, Guard Patrol function, panel, system module, “software - defined zone,” Operator Control, or Time Control function within the system.

    d. Activate: The system shall allow the operator to manually turn on any system output point or system function. Alternate smoke detector sensitivity, message routing within the system, guard patrol timing, and check-in group timings shall be modifiable with this simple command from the control panel.

    e. Restore: The system shall allow the operator to restore the primary (application-program defined) operation to the smoke detector sensitivity and the message routing functions with this simple command from the control panel.

    f. Control Output: The system shall allow the operator to manually command and control relays and LEDs. Relays shall be able to be commanded to “Latch,” to energize as a “High Priority,” or as a “Low Priority,” to “Energize,” or to “De-Energize.”

10. LEDs shall be able to be commanded to “Latch,” to energize as a “High Priority,” or as a “Low Priority,” to turn “On,” to turn “Off,” to “Slow Blink,” or to “Fast Blink.”

11. Reports: The system shall provide the operator with system reports that give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any of the connected system printers.

    a. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining.

    b. The system shall provide a report that provides a sensitivity listing of any particular detector.

    c. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given SDC loop within any given panel.

    d. The system shall provide a report that gives a chronological listing of up to the last 1,740 system events.

    e. The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

    f. Program: The system shall allow the authorized operator to perform all of the following system functions:

        1) Set the system time.

        2) Set the system date.

        3) Set (change) the system passwords.

        4) Restart the system.

        5) Set the dates for the system holiday schedule.

        6) Clear the chronological system history file.

12. Test: The system shall allow the authorized operator to perform Test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per-cabinet, per-circuit, or per-service-group basis.

13. Local Control and Display Annunciators: Each panel in the installed system shall include local control and display annunciators. These annunciators shall have integral membrane style, tactile pushbutton control switches, for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.

    a. The local control display annunciators shall provide the system with individual zone and/or device annunciation.

    b. The local control display annunciators shall provide the system with individual zone and/or device annunciation with zone and/or device disable.

c. The local control and display annunciators shall provide the system with groups of three switches that have software-controlled interlocks to allow only one of the switches to be active at any time.

d. The switch triads shall be used for all of the fan and damper controls in the protected premises.

C. Life Safety System Operations Interface:

1. Signature Device Card (SDC): The SDC shall be the interface between the fire alarm control panel and the Signature Series detectors and modules. The communications format between the SDC and the Signature Series devices shall be 100% digital.

2. Communications to devices must incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.

3. It shall be possible to wire the SDC as Class A (Style 6 or Style 7) or Class B (Style 4) without twisted or shielded wire. It must be possible to wire branch circuits (T-taps) from Class-B circuits. The associated controller (3-SSDC), through the SDC, shall provide the ability to set the sensitivity and alarm verification of each of the individual intelligent detectors on the circuit. It shall be possible to automatically set the sensitivity of individual intelligent detectors during day and night periods.

4. It shall be possible for the SDC to address all intelligent devices connected to it without having to set switches at the individual devices.

5. It shall be possible to obtain a mapping report of all devices connected to the circuit for confirmation of “as-built” wiring. The map shall show physical wiring of T-taps, device types, and the panel addresses of devices connected to the circuit. The SDC shall be capable of reporting unexpected additional device addresses and changes to the wiring in the data circuit. A specific trouble shall be reported for any off-normal non-alarm condition.

6. The SDC shall be able to report the following information on a per-intelligent-device basis:

a. Device serial number.

b. Device address.

c. Device type.

d. Current detector sensitivity values and the extent of environmental compensation.

e. Any of 32 possible trouble codes to specifically diagnose faults.

7. Should a signature driver controller CPU fail to communicate, the signature circuit shall go into the Standalone mode. The circuit shall be capable of producing a loop alarm if an alarm-type device becomes active during Standalone mode.

D. Hard-Wired Notification Appliance Circuits (NAC):

1. Provide, where indicated on the plans, supervised hard-wired notification appliance circuits (NAC) for the control of 24 VDC, EST Integrity Series signaling appliances. The NAC shall be Class B (Style 4) and shall control up to 3.5 amps of power to the circuit.

2. Provide, where indicated on the plans, supervised hard-wired NACs for the control of 70.7 Vrms EST Integrity Series audio-signaling appliances. The NAC shall be Class B (Style 4) and shall control up to 35 watts of power to the circuit.

3. Provide, where indicated on the plans, supervised hard-wired NACs for the control of 25 Vrms EST Integrity Series audio-signaling appliances. The NAC shall be Class B (Style 4) and shall control up to 50 watts of power to the circuit.

4. Panel NACs shall be power limited to 3.5A at 24 VDC and 4.1A at 20.4 VDC to support higher current demand by visible appliances at lower battery voltages.

E. Hard-Wired Initiating Device Circuits (IDCs): Provide, where indicated on the plans, supervised, hard-wired initiating device circuits. It shall be possible to configure IDCs for alarm, supervisory, or monitor operation.

F. Life Safety System Programmable Operations:

1. System Message Processing and Display Operations:

a. The fire alarm/life safety system shall allow network routing to be configured to any or all nodes (cabinets) in the network.

b. All of the system printer ports can be configured to display any or all of the following functions:

1) Alarm.

2) Supervisory.

3) Trouble.

4) Monitor.

5) Service Group.

2. Each LCD display on each node (cabinet) in the system shall be configurable to show the status of any or all of the following functions anywhere in the system:

a. Alarm.

b. Supervisory.

c. Trouble.

d. Monitor.

3. The system shall provide the capability to label each of the system points with up to 256 characters of location message. The first 42 characters shall be directed to the LCD, while the entire message shall be sent to the printer.

4. The system shall have the capability to provide up to 128 Logical Counting AND Groups. Each group shall have a programmable “activation” number. Whenever the number of active devices in an AND Group reaches the activation number, the AND Group’s rules will execute. It shall be possible to “overlap” AND Groups by having devices appear in more than one group.

5. The system shall provide a means to monitor the well-being of any or all of the occupants of the protected premises by means of a Check-In Group feature. The Check-In Group shall display an emergency alarm whenever any member of a Check-In Group fails to check-in during the programmable check-in period.

6. Subsequent check-in activations during the check-in period, or activations outside of the check-in period, shall also activate an emergency response. It shall be possible to have a minimum of 128 Check-In Groups. All event messages for the Check-In feature shall be directable to any system monitor or printer.

7. The system shall have the ability to define a minimum of 64 Guard Patrols with up to 10 different tours each. For each tour, it shall be possible to program a minimum-maximum time period between patrol stations. Each Guard Patrol can have up to 50 stations. Guard Patrol can be started from the control panel or by operation of the first station in a tour. Guard Patrol delinquencies occur when a guard is early to a station, late to a station and out of sequence. Delinquencies shall display at the control panel, perform programmable system responses, and may be directed to any printer.

8. The system shall have the ability to define a minimum of 128 Matrix Groups with up to 250 points each. For each matrix, it shall be possible to define a “radius” and an “activation” number. The radius number defines the proximity between detector locations. When two detectors activate at or within the value of the “radius” or whenever the number of active devices reaches the activation number, the Matrix Group activates. It shall be possible to “overlap” Matrix Groups by having devices appear in more than one group.

9. The system shall include the ability to define an alternate set of device commands that may be used in combination with the system test command for the testing of the connected Signature Series smoke detectors. This function shall disable the normal alarm command for each of the members of the group, so that the testing process will not result in an activation of the building evacuation signals, auxiliary relays, or central station connections.

10. The system shall include Time Control functions that will have the ability to control any system output or function, or initiate any system operational sequence as a function of the month, day of week, date, hour, minute, or holiday.

11. The system shall include up to 600 software-defined Logical Zone Groups that may group any input from any signature data circuit, or other IDC, in order to control a system output or function, or initiate any system operational sequence. A device or IDC may be a member of one Logical Zone Group. Each of these zones shall have an associated message.

12. The system shall provide the ability to download data from the Signature Series detectors to a PC while the system is online and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.

2.6 COMPONENTS

A. Remote Booster Power Supplies:

1. General: The power supply shall provide a central processor with a watchdog circuit. It shall provide two initiating circuits, two NACs rated at 24 VDC at 2.5 amps, Form "C" alarm and trouble contacts, and auxiliary power at 24 VDC at 500 mA. The power supply shall be a high-efficiency Switch mode type providing 4 amps total to the NACs, 500 mA of auxiliary power at 24 VDC, and an automatic battery charger capable of supporting up to 10 AH of sealed lead-acid batteries. Site programming shall enable or disable the local trouble buzzer, allow the following of existing signal rates or select internally generated evacuation signal rates at continuous, 20 SPM, 120 SPM, temporal 3-3-3, or California continuous or march time independent of the existing signal rate. Indicators shall be Power On, System Trouble, Ground Fault, Battery Trouble, and Notification Appliance Circuit Trouble. It shall be possible to activate the booster power supply via dry contact or by connection to an existing NAC circuit. It shall be possible to convert the booster power supply circuits' ICs and NACs to Class A operation. The base panel shall provide a communication channel and operating power for expansion modules.

2. Remote Booster Power Supply (BPS):

a. The remote BPS shall be an EST Type BPS-Series incorporating all control electronics, relays, and necessary modules and components in a surface-mounted cabinet. The panel shall be supervised, site programmable, modular design with expansion modules to serve connection to existing NAC circuits. All initiating, notification, and low-voltage power source circuits shall be power limited.

b. The BPS shall be provided with battery backup. The batteries shall be of the sealed, lead-acid type and provide 24 hours of normal standby operation and 5 minutes of normal alarm operation at the end of the standby period. The batteries shall be supervised for placement and low voltage. It shall be possible to mount the batteries remote from the panel.

c. The Relay/City module shall have a yellow LED and an enable/disable switch. It shall be configurable with the BPS to serve as an auxiliary relay.

B. Intelligent Detectors – General:

1. The system intelligent detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions and time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

2. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.5 seconds.

3. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate Alarm-Standalone mode status. Both LEDs shall be visible through a full 360-degree viewing angle.

4. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

5. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble, and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five sensitivity settings.

6. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient “environmental thresholds” approximately 6 times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminants, as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24-hour long-term and 4-hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” baseline sensitivity. The baseline sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

7. The intelligent analog device and the analog loop controller shall provide increased reliability and inherent survivability through intelligent Analog Standalone operation. The device shall automatically change to standalone conventional device operation in the event of a loop controller polling communications failure.

8. In the Analog Standalone Detector mode, the analog detector shall continue to operate using sensitivity and environmental compensation information stored in its microprocessor at the time of communications failure. The analog loop controller shall monitor the loop and activate a loop alarm if any detector reaches its alarm sensitivity threshold.

9. Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector, shall not be acceptable.

10. The intelligent analog detectors shall be suitable for mounting on any Signature Series detector mounting base.

C. Fixed Temperature Heat Detector:

1. Provide intelligent fixed temperature heat detectors EST Model SIGA-HFS. The heat detector shall have a low-mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.

2. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70-foot (21.3-m) centers and be suitable for wall mount applications.

D. Fixed Temperature/Rate-of-Rise Heat Detector: Provide intelligent combination fixed temperature/rate-of-rise heat detectors EST Model SIGA-HRS. The heat detector shall have a low-mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70-foot (21.3-m) centers and be suitable for wall mount applications.

E. Ionization Smoke Detector:

1. Provide intelligent ionization smoke detectors EST Model SIGA-IS. The analog ionization detector shall utilize a unipolar ionization smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the EST Model SIGA-PRO Signature Program/Service Tool. The ion detector shall be rated for ceiling installation at a minimum of 30-foot (9.1-m) centers and be suitable for wall mount applications. The ion smoke detector shall be rated for operation in constant air velocities from 0 to 75 feet per minute (0 to 0.38 m/sec) and with intermittent air gusts up to 300 feet per minute (1.52 m/sec) for up to 1 hour.

2. The percent smoke obscuration per foot alarm setpoint shall be field selectable to any of five sensitivity settings ranging from 0.7% to 1.6%. The ion detector shall be suitable for operation in the following environment:

a. Temperature: 32°F to 120°F (0°C to 49°C).

b. Humidity: 0–93% RH, non-condensing.

c. Elevation: Up to 6,000 feet (1,828 m).

F. Photoelectric Smoke Detector:

1. Provide intelligent photoelectric smoke detectors EST Model SIGA-PS. The analog photoelectric detector shall utilize a light-scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the EST Model SIGA-PRO Signature Program/Service Tool. The photo detector shall be rated for ceiling installation at a minimum of 30-foot (9.1-m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 feet (0.91 m) high and 3 feet (0.91 m) wide with air velocities up to 5,000 feet per minute (0 to 25.39 m/sec) without requiring specific duct detector housings or supply tubes.

2. The percent smoke obscuration per foot alarm setpoint shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 120°F (0°C to 49°C).

   b. Humidity: 0–93% RH, non-condensing.

   c. Elevation: No limit.

G. 3D Multisensor Detector:

1. Provide intelligent 3D multisensor smoke detectors EST Model SIGA-PHS. The multisensor analog detector shall use a light-scattering type photoelectric smoke sensor and a fixed-temperature type heat sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time-based algorithms to dynamically examine values from both sensors simultaneously and initiate an alarm based on that data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the EST Model SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors and heat detectors in the same location are not acceptable alternatives. The 3D multisensor detector shall be rated for ceiling installation at a minimum of 30-foot (9.1-m) centers and be suitable for wall mount applications. The 3D multisensor smoke detector shall be suitable for direct insertion into air ducts up to 3 feet (0.91 m) high and 3 feet (0.91 m) wide and with air velocities up to 5,000 feet per minute (0 to 25.39 m/sec) without requiring specific duct detector housings or supply tubes. The percent smoke obscuration per foot alarm setpoint shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The fixed temperature alarm setpoint shall be 135°F (57°C) nominal.

2. The 3D multisensor detector shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 100°F (0°C to 38°C).

   b. Humidity: 0–93% RH, non-condensing.

   c. Elevation: No limit.

H. 4D Multisensor Detector:

1. Provide intelligent 4D multisensor smoke detectors EST Model SIGA-IPHS. The multisensor analog detector shall use a light-scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor, and an ambient temperature sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time-based algorithms to dynamically examine values from the three sensors simultaneously and initiate an alarm based on that data. The 4D multisensor shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65°F (35°C) in ambient temperature. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, age, and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the EST Model SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors, ionization detectors, and heat detectors in the same location are not acceptable alternatives. The 4D multisensor smoke detector shall be rated for ceiling installation at a minimum of 30-foot (9.1-m) centers and suitable for wall mount applications. The 4D multisensor shall be suitable for direct insertion into air ducts up to 3 feet (0.91 m) high and 3 feet (0.91 m) wide and air velocities up to 500 feet per minute (0 to 2.54 m/sec) without requiring specific duct detector housings or supply tubes.

2. The percent smoke obscuration per foot alarm setpoint shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The integral heat sensor shall cause an alarm when it senses a change in ambient temperature of 65°F (35°C) or reaches its fixed temperature alarm setpoint of 135°F (57°C) nominal. The 4D multisensor detector shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 100°F (0°C to 38°C).

   b. Humidity: 0–93% RH, non-condensing.

   c. Elevation: Up to 6,000 feet (1,828 m).

I. Standard Detector Mounting Bases: Provide standard detector mounting bases EST Model SIGA-SB suitable for mounting on North American 1-gang, 3-1/2-inch or 4-inch octagon box and 4-inch square box. The base shall contain no electronics, support all Signature Series detector types, and have the following minimum requirements:

1. Removal of the respective detector shall not affect communications with other detectors.

2. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

3. The base shall be capable of supporting one EST Signature Series Model SIGA-LED remote alarm LED indicator. Provide remote LED alarm indicators where shown on the plans.

J. Relay Detector Mounting Bases: Provide relay detector mounting bases EST Model SIGA-RB suitable for mounting on North American 1-gang, 3-1/2-inch or 4-inch octagon box and 4-inch square box. The relay base shall support all Signature Series detector types and have the following minimum requirements:

1. The relay shall be a bi-stable type and selectable for normally-open or normally-closed operation.

2. The position of the contact shall be supervised.

3. The relay operation shall be exercised by the detector processor upon power up.

4. The relay shall automatically de-energize when a detector is removed.

5. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating in Standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.

6. Form “C” relay contacts shall have a minimum rating of 1 amp at 30 VDC and be listed for “pilot duty.”

7. Removal of the respective detector shall not affect communications with other detectors.

8. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

K. Isolator Detector Mounting Bases:

1. Provide isolator detector mounting bases EST Model SIGA-IB suitable for mounting on North American 1-gang, 3-1/2-inch or 4-inch octagon box and 4-inch square box. The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted. Following a short-circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self-tests shall not be acceptable.

2. The isolator base shall support all Signature Series detector types and have the following minimum requirements:

a. The isolator shall operate within a minimum of 23 msec. of a short-circuit condition on the communication line.

b. When connected in Class A configuration, the signature loop controller shall identify an isolated circuit condition and provide communications to all non-isolated analog devices.

c. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

L. Detector Mounting Plate: Provide detector mounting plate assemblies EST Model SIGA-DMP to facilitate mounting a Signature Series detector for direct insertion into a low-velocity duct 3 feet (0.91 m) high and 3 feet (0.91 m) wide, ceiling plenum, or raised floor. Mounting plate shall be code gauge steel with corrosion-resistant red enamel finish. The detector mounting plate shall support an intelligent analog photoelectric detector EST Model SIGA-PS, or 3D multisensor detector EST Model SIGA-PHS, or 4D multisensor detector EST Model SIGA-IPHS, along with a standard, relay, or isolator detector mounting base.

M. Intelligent Modules:

1. General: It shall be possible to address each intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the analog loop controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of two diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

   a. Temperature: 32°F to 120°F (0°C to 49°C).

   b. Humidity: 0–93% RH, non-condensing.

2. Single Input Module: Provide intelligent single input modules EST Model SIGA-CT1. The single input module shall provide one supervised Class B input circuit capable of a minimum of four personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 1-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 1-gang covers. The single input module shall support the following circuit types:

   a. Normally-open alarm latching (manual stations, heat detectors, etc.).

   b. Normally-open alarm delayed latching (waterflow switches).

   c. Normally-open active non-latching (monitor, fans, dampers, doors, etc.).

   d. Normally-open active latching (supervisory, tamper switches).

3. Dual Input Module: Provide intelligent dual input modules EST Model SIGA-CT2. The dual input module shall provide two supervised Class B input circuits, each capable of a minimum of four personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 1-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 1-gang covers. The dual input module shall support the following circuit types:

    a. Normally-open alarm latching (manual stations, heat detectors, etc.).

    b. Normally-open alarm delayed latching (waterflow switches).

    c. Normally-open active non-latching (monitor, fans, dampers, doors, etc.).

    d. Normally-open active latching (supervisory, tamper switches).

4. Monitor Module: Provide intelligent monitor modules EST Model SIGA-MM1. The monitor module shall be factory-set to support one supervised Class B normally-open active non-latching monitor circuit. The monitor module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 1-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 1-gang covers.

5. Waterflow/Tamper Module: Provide intelligent waterflow/tamper modules EST Model SIGA-WTM. The waterflow/tamper module shall be factory-set to support two supervised Class B input circuits. Channel A shall support a normally-open alarm delayed latching waterflow switch circuit. Channel B shall support a normally-open active latching tamper switch. The waterflow/tamper module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 1-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 1-gang covers.

6. Single Input Signal Module: Provide intelligent single input signal modules EST Model SIGA-CC1. The single input (single riser select) signal module shall provide one supervised Class B output circuit capable of a minimum of two personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own “ring tone.” The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 2-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 2-gang covers. The single input signal module shall support the following operations:

    a. Audible/Visible signal power selector (polarized 24 VDC at 2 amps, 25 Vrms at 50 watts, or 70 Vrms at 35 watts of audio).

    b. Telephone power selector with ring tone (firefighter’s telephone).

7. Dual Input Signal Module:

    a. Provide intelligent dual input signal modules EST Model SIGA-CC2. The dual input (dual riser select) signal module shall provide a means to selectively connect one of two signaling circuit power risers to one supervised output circuit. The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 2-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 2-gang covers.

b. The dual input signal module shall support the following operation:

1) Audible/Visible signal power selector (polarized 24 VDC at 2 amps, 25 Vrms at 50 watts, or 70 Vrms at 35 watts of audio).

8. Control Relay Module: Provide intelligent control relay modules EST Model SIGA-CR. The control relay module shall provide one Form "C" dry relay contact rated at 2 amps at 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 1-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 1-gang covers.

9. Universal Class A/B Module: Provide intelligent Class A/B modules EST Model SIGA-UM. The universal Class A/B module shall be capable of a minimum of 15 distinct operations. The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 2-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 2-gang covers. The universal Class A/B module shall support the following circuit types:

a. One supervised Class A normally-open alarm latching.

b. One supervised Class A normally-open alarm delayed latching.

c. One supervised Class A normally-open active non-latching.

d. One supervised Class A normally-open active latching.

e. One supervised Class A 2-wire smoke alarm non-verified.

f. One supervised Class A 2-wire smoke alarm verified.

g. One supervised Class A signal circuit, 24 VDC at 2 amps.

10. Isolator Module: Provide intelligent fault isolators modules EST Model SIGA-IM. The isolator module shall be capable of isolating and removing a fault from a Class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2-1/2-inch (64-mm) deep 2-gang boxes and 1-1/2-inch (38-mm) deep 4-inch square boxes with 2-gang covers.

N. Intelligent Manual Pull Stations - General:

1. It shall be possible to address each Signature Series fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of two diagnostic LEDs mounted on their integral, factory-assembled, single- or two-stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults.

2. The fire alarm pull station shall be suitable for operation in the following environment:

a. Temperature: 32°F to 120°F (0°C to 49°C).

b. Humidity: 0–93% RH, non-condensing.

O. Conventional Fire Alarm Initiating Devices - General:

1. All initiating devices shall be UL Listed for Fire Protective Service. All initiating devices shall be of the same manufacturer as the fire alarm control panel specified to assure absolute compatibility between the devices and the control panels, and to assure that the application of the initiating devices is done in accordance with the single manufacturer's instructions.

2. Any devices that do not meet the above requirements, and are submitted for use, must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

P. Heat Detectors:

1. Combination Fixed Temperature/Rate-of-Rise Heat Detectors EST Model 281B: Provide low-profile heat detectors rated for a maximum smooth ceiling rating of 2,500 sq.ft. (232 m2). The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 15°F (9°C) per minute rate-of-rise and 135°F (57°C) fixed temperature.

2. Fixed Temperature Heat Detectors EST Model 283B: Provide low-profile heat detectors rated for a maximum smooth ceiling rating of 2,500 sq.ft. (232 m2). The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at 135°F (57°C) fixed temperature.

Q. Smoke Detectors:

1. Ionization Smoke Detectors EST 6250 Series: Provide stable, solid-state, unipolar ionization detectors capable of detecting visible and invisible products of combustion. Provide the detectors with a measuring chamber and a protected reference chamber sensitive to changes in temperature and humidity only. Protect the measuring chamber from damage and insects. Provide a built-in 5-second delay to minimize alarms due to transient smoke. Safeguard radioactive parts and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal. Factory-set the detector sensitivity and provide for field adjustment within the range of ULI defined sensitivity. Connect remote LED alarm indicators where shown on the plans. The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol sprays.

2. Photoelectric Smoke Detectors EST 6270 Series: Provide stable, solid-state, photoelectric detectors capable of detecting visible products of combustion. Provide the detectors with self-compensating circuitry to protect its stability against the effects of aging, dust, and film accumulation. Protect the measuring chamber from damage and insects. Provide a built-in 5-second delay to minimize alarms due to transient smoke. Safeguard and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal. Factory-set the detector sensitivity. Connect a remote LED alarm indicator where shown on the plans. The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol sprays. Provide an auxiliary 135°F (57°C) fixed temperature heat detector.

3. Beam-Type Smoke Detectors EST Model 6424: Provide projected beam-type smoke detectors. The beam detectors shall be 4-wire 24 VDC and powered from the control panel 4-wire smoke power source. This unit shall consist of a separate transmitter and receiver capable of being powered separately or together. This unit shall operate in either a short range of 30 to 100 feet (9.14 to 30.4 m) or a long range of 100 to 300 feet (30.4 to 91.4 m). The detector shall feature a bank of four alignment LEDs on both the receiver and transmitter that are used to ensure proper alignment without the use of special tools. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses. Ceiling or wall mount as shown on the plans. Testing shall be carried out using calibrated test filters. Provide a magnet activated remote test station.

R. Notification Appliances - General: All appliances shall be UL Listed for Fire Protective Service. All strobe appliances or combination appliances with strobes shall be capable of providing the “equivalent facilitation” which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 and ULC S526 Listed. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances is done in accordance with the single manufacturer’s instructions. Any appliances which do not meet the above requirements, and are submitted for use, must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

S. Self-Synchronized Strobes:

1. One-Gang Strobes EST 202 Series: In-Out screw terminals shall be provided for wiring. The strobes shall have a white plastic faceplate. They shall provide synchronized flash outputs. Strobes shall mount in a North American 1-gang box. The strobe shall have lens markings oriented for ceiling mounting. It shall be possible to replace the lens markings with LKW Series or LKC Series lens marking kits. Ceiling-mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed strobe to change the lens markings shall not be acceptable. Provide weatherproof wall boxes for outdoor mounting.

2. Strobes EST 405 Series: In-Out screw terminals shall be provided for wiring. The strobes shall have a white metal faceplate. They shall provide synchronized flash outputs. Strobes shall mount in a North American 4-inch square box. The strobe shall have lens markings oriented for ceiling mounting. It shall be possible to replace the lens markings with LKW Series or LKC Series lens marking kits. Ceiling-mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed strobe to change the lens markings shall not be acceptable. Provide weatherproof wall boxes for outdoor mounting.

T. Horns:

1. Electronic Mini-Horns EST 682 Series: In-Out screw terminals shall be provided for wiring. The horn shall have a white plastic housing. A sound output level of 91 dBA shall be provided. Horn shall mount to a North American 1-gang masonry electrical box (2-1/2 inches deep).

2. Electronic Temporal Horns EST 757 Series: In-Out screw terminals shall be provided for wiring. The horn shall have a white plastic housing. Horns shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. A synchronized temporal pattern sound output level of 100 dBA shall be provided. Horn shall mount to a North American 4-inch electrical box (2-1/8 inches deep) using the two screws provided with box, or to a 2-gang (2-3/4 inches deep) electric box. Provide weatherproof wall boxes for outdoor mounting.

U. Horn/Strobes:

1. Electronic Mini-Horn/Strobes EST 692 Series: The horn/strobe shall have a white plastic housing. A sound output level of 91 dBA average shall be provided. The strobe shall provide synchronized flash outputs. The strobe shall have lens markings oriented for ceiling mounting. It shall be possible to replace the lens markings with LKW Series or LKC Series lens marking kits. Ceiling-mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed horn/strobe to change the lens markings shall not be acceptable. Horn/strobe shall mount to a North American 1-gang masonry electrical box (2-1/2 inches deep).

2. Electronic Temporal Horn/Strobes EST 757 Series: In-Out screw terminals shall be provided for wiring. The horn/strobe shall have a white plastic housing. Horn/strobes shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. A synchronized temporal pattern sound output level of 97 dBA average shall be provided. The strobe shall provide synchronized flash outputs. The strobe shall have lens markings oriented for ceiling mounting. It shall be possible to replace the lens markings with LKW Series or LKC Series lens marking kits. Ceiling-mounted strobes shall have lens markings with correctly oriented lettering. Removal of an installed horn/strobe to change the lens markings shall not be acceptable. Horn/strobe shall mount to a North American 4-inch electrical box (2-1/8 inches deep) using the two screws provided with box, or to a 2-gang (2-3/4 inches deep) electric box. Provide weatherproof wall boxes for outdoor mounting.

V. Remote Relays:

1. Multivoltage Control Relays EST MR-100 Series: Provide remote-control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amps at 115 VAC. A single relay may be energized from a voltage source of 24 VDC, 24 VAC, 115 VAC, or 230 VAC. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

2. Multivoltage Control Relays EST MR-200 Series: Provide remote-control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 10 amps at 115 VAC. A single relay may be energized from a voltage source of 24 VDC, 24 VAC, 115 VAC, or 230 VAC. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

3. Multivoltage Control Relays EST MR-700 Series: Provide remote-control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amps at 115 VAC. A single relay may be energized from a voltage source of 12 VDC, 12 VAC, 24 VDC, or 24 VAC. A red LED shall indicate the relay is energized.

4. Multivoltage Control Relays EST MR-800 Series: Provide remote-control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amps at 115 VAC. A single relay may be energized from a voltage source of 24 VDC, or 24 VAC, or 115 VAC. A red LED shall indicate the relay is energized.

5. Manual Override Control Relays EST MR-600 Series: Provide remote-control relays each with manual override feature connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amps at 115 VAC or 24 VDC. A single relay may be energized from a voltage source of 24 VDC or 24 VAC. A red LED shall indicate the relay is energized.

6. Heavy-Duty Power Relays EST MR-199 Series: Provide remote-control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 30 amps at 300 VAC or 2 HP motor load. A single relay may be energized from a voltage source of 24 VAC. A metal enclosure shall be provided.

W. Electromagnetic Door Holders:

1. Electromagnetic door holders submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

2. Electromagnetic Door Holders EST 1500 Series:

   a. Floor Mounted EST 1501/1502 Series: Provide single door floor-mounted electromagnetic door holder/releases rated at 24 VAC/DC input. Finish shall be brushed zinc.

b. Wall Mounted EST 1504/1505/1508/1509 Series: Provide surface wall-mounted electromagnetic door holder/releases rated at 24 VAC/DC: Finish shall be brushed zinc.

X. Telephone Devices:

1. All telephone devices shall be UL Listed for Fire Protective Service.

2. All telephone devices shall be of the same manufacturer as the fire alarm control panel specified to assure absolute compatibility between the telephone devices and the control panels, and to assure that the application of the appliances is done in accordance with the single manufacturer's instructions.

3. Any telephone devices that do not meet the above requirements, and are submitted for use, must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

2.7 GRAPHICAL COMMAND WORKSTATION

A. The graphical command workstation(s) shall display a different color text for each message type and color graphic diagrams/floor plans. The graphical command workstation shall simultaneously display the following system event views: System Event Display, Graphical Diagram Display, Detailed Event Message/Instructions, and User Event Log. The workstation shall be an IBM-compatible personal computer listed for UL 864 (Control Units for Fire-Protective Signaling Systems) under Categories UOJZ, APOU, and UUKL. The workstation(s) shall be capable of annunciation and control of all fire detection and smoke control points.

B. The computer shall be a minimum of a Pentium Grade Pentium Processor 2.4 GHz with a 533 MHz front side bus, 512 MB RAM, 80 GB Hard Drive, and 19-inch LCD monitor. Installation of the computer or monitor can be either desktop, floor, or rack/panel mounting.

C. The software shall provide multitasking type environment that allows the user to run several applications simultaneously. The operating program shall run within a 32-bit operating system such as Windows® XP. These Windows applications shall run simultaneously with other programs. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows-based software packages, while concurrently annunciating online alarms and monitoring functions.

D. Graphic Workstation Operations:

1. The graphic display screen shall organize and structure system events for easy user comprehension. The workstation display shall use four relational quadrants. When any event occurs:

a. The "list of events area" shall display the address of the alarm or off-normal point with type, description, and time of the event in a prioritized color-coded event list. Highlighting an event in the event list area shall automatically cause the display of a graphical map, and the other three areas (described below) to display information relating to the highlighted event.

1) The “map area” shall display color graphical representation of the area location in which the alarm or off-normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered equal.

2) The “event action area” shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator’s log shall record operator’s comments for each event in system history with time and date.

3) The “image area” shall display a stored image of the device relating to the event highlighted in the event list area.

2. When processing fire alarm events, the graphic workstation shall be capable of:

a. Acknowledging, silencing, and resetting all fire alarm functions.

b. Manually activating, deactivating, enabling, and disabling individual fire alarm points.

c. Generating status, maintenance, and sensitivity reports for fire alarm components.

3. Receipt of a fire alarm shall activate an audio WAV file over the workstation speakers alerting the operator to a fire alarm, and providing audible instructions.

4. The graphical command workstation(s) shall be EST Cat. No. FW-CGSUL FireWorks standalone workstation complete with all software and hardware programming required to operate with EST fire alarm life safety and property protection systems.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system according to NFPA Standards, with special attention to Section 760.

B. Fire Alarm Power Supply Disconnect: Shall be painted red and labeled “FIRE ALARM.” Provide with a lockable handle or cover.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete fire alarm system as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles 48 inches above finished floor or as indicated.

C. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches from a sidewall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.

D. Audible Notification Appliances: Install not less than 80 inches above the finished floor nor less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual notification appliances at the same location into a single unit.

E. Visual Notification Appliances: Install adjacent to each alarm bell or alarm horn and not less than 80 inches above the finished floor and at least 6 inches below the ceiling.

F. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

G. Fire Alarm Control Unit (FACU): Surface mount with tops of cabinets not more than 6 feet above the finished floor.

H. Graphic Annunciator: Arrange as indicated, with the top of the unit no more than 6 feet above the finished floor.

3.3 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Specification Section 26 05 33, Raceway and Boxes for Electrical Systems. Conceal raceway except in unfinished spaces and as indicated.

B. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull, or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

D. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the AHJ and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC) (NFPA 70). It is the Contractor’s responsibility to obtain from the fire alarm system manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the fire alarm system manufacturer.

E. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm IDC wiring and a different color code for supervisory circuits. Color code NACs differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

F. Fan Shutdown: Air handling equipment shall be connected to relays in its respective duct smoke detector.

3.4 GROUNDING

A. Ground equipment and conductor and cable shields as specified by the equipment manufacturer. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the drawings and specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.

2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1 megohm for evaluation.

3. Test all conductors for short circuits utilizing an insulation-testing device.

4. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.

5. Verify the control unit is in the normal condition as detailed in the manufacturer's Operation & Maintenance Manual.

6. Test initiating, notification, and signaling circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10% of the initiating and notification devices. Observe proper signal transmission according to class of wiring used.

7. Test each initiating device and notification appliance for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

8. Measure and record the actual current draw of each NAC.

9. Test the system for all specified functions according to the manufacturer's Operation & Maintenance Manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.

10. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

I. Final Test, Certificate of Completion, and Certificate of Occupancy: Test the system as required by the AHJ in order to obtain a Certificate of Occupancy. Demonstrate that the system meets the specifications and complies with applicable standards. This final test shall be witnessed by a representative of the AHJ and a factory-authorized service representative.

3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by the manufacturer.

B. Occupancy Adjustments: When requested within 1 year of date of Substantial Completion, provide onsite assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner’s maintenance personnel as specified below.

1. Train Owner’s maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours of training.

2. Schedule training with the Owner at least 7 days in advance.

END OF SECTION

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"General Decision Number: AZ20240027 01/05/2024

Addendum 4
supersedes APPENDIX A
in Bid Specifications

Superseded General Decision Number: AZ20230027

State: Arizona

Construction Type: Building
BUILDING CONSTRUCTION, Includes Building Construction on Treatment Plants and on Industrial Sites (Chemical/Processing/Manufacturing Plants, Power Plants, Refineries, Nuclear Plants, Etc.)

County: Navajo County in Arizona.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/05/2024

BRAZ0003-009 07/01/2023

	Rates	Fringes
BRICKLAYER	$ 32.74	9.52

ZONE PAY:

(Radius miles from the intersection of Central Ave. and Washington St., Phoenix, AZ)

Zone A: 0-60 miles- Base Rate
Zone B: 61-75 miles- Base Rate plus $2.00 per hour
Zone C: 75-100 miles- Base Rate plus $3.00 per hour
Zone D: 101-200 miles- Base Rate plus $3.50 per hour
Zone E: Over 200 miles- Base Rate plus $6.50 per hour

CARP0408-001 07/01/2023

	Rates	Fringes
CARPENTER	$ 33.55	14.17

CARP1327-001 07/01/2019

	Rates	Fringes
CARPENTER (Drywall Hanging Only)	$ 26.24	8.86

ELEC0518-011 08/01/2023

(South and East of boundary beginning at a point where clear Creek crosses the Coconino-Navajo County Line, extending North-easterly along Clear Creek and North-easterly to Cottonwood Wash, along Cottonwood Wash North-easterly to intersection with Navajo Reservation, East along Navajo

Reservation Boundary line to intersection with Navajo/Apache County lines)

	Rates	Fringes
ELECTRICIAN (Includes Alarm Installation and Low Voltage Wiring)	$ 32.50	9.50+13.25%

ELEC0640-010 01/01/2023

(Remaining Part)

	Rates	Fringes
ELECTRICIAN (Includes Alarm Installation and Low Voltage Wiring)	$ 33.10	13.58

ENGI0428-003 06/01/2022

	Rates	Fringes
POWER EQUIPMENT OPERATOR (CRANE)		
(2) under 15 tons	$ 33.41	12.57
(3) 15 tons to 100 tons, Tower Crane	$ 34.49	12.57
(4) 100 tons and over	$ 35.52	12.57

IRON0075-002 07/31/2023

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL	$ 29.00	17.44

Zone 1: 0 to 50 miles from City Hall in Phoenix or Tucson
Zone 2: 050 to 100 miles - Add $4.00
Zone 3: 100 to 150 miles - Add $5.00
Zone 4: 150 miles & over - Add $6.50

LABO1184-010 06/01/2023

	Rates	Fringes
LABORER (MASON TENDER-BRICK)	$ 24.18	7.59

PAIN0086-006 06/30/2021

	Rates	Fringes

DRYWALL FINISHER/TAPER
ZONE A.....$ 23.55 7.49
ZONE B.....$ 27.05 7.49

ZONE PAY:

ZONE A: Free Zone: A distance of 0 to 100 miles from the old Phoenix courthouse.

ZONE B: A distance of 101 miles and over from the old Phoenix courthouse: $3.50 per hour over ZONE A

ROOF0135-002 07/01/2022

Rates Fringes

ROOFER (Includes Installation of Metal Roofs).....$ 25.11 7.15

SUAZ2012-016 05/30/2012

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...$ 17.71 2.60

FLOOR LAYER: Hardwood and Resilient Flooring.....$ 17.98 6.50

GLAZIER.....$ 15.98 ** 0.79

LABORER: Common or General.....$ 11.98 ** 3.13

LABORER: Landscape & Irrigation.....$ 9.31 ** 0.00

LABORER: Mason Tender - Cement/Concrete.....$ 16.05 ** 1.49

OPERATOR: Backhoe.....$ 14.00 ** 1.80

PAINTER: Brush, Roller and Spray.....$ 16.13 ** 0.00

PIPEFITTER.....$ 22.21 6.12

PLUMBER.....$ 19.63 2.83

SHEET METAL WORKER.....$ 18.68 4.91

SPRINKLER FITTER (Fire Sprinklers).....$ 16.48 ** 2.94

TILE SETTER.....$ 15.93 ** 0.45

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is

based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

APPENDIX B

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

August 22, 2009

White Mountain Apache Tribe
P.O. Box 590
White River, Arizona 85941

Attn: Franklin Quintero Sr., Construction Manager

RE: Part-Time Abatement Oversight and Testing Services Following the Removal of Hazards Historic Building 116/Boy's Dormitory in Fort Apache, Arizona
Tallpines Job No. 09TEC104.CLR

1.0 INTRODUCTION

Tallpines Environmental Consulting Co. (Tallpines), Flagstaff, has completed part-time abatement oversight and testing services following the removal of hazards from Building 116/Boy's Dormitory located in the Fort Apache Historic District in Fort Apache, Arizona (the Site). Tallpines was authorized by Franklin Quintero Sr., Construction Manager, White Mountain Apache Tribe (WMA Tribe), to perform the industrial hygiene services for this project in general accordance with Tallpines' Proposal No. 08P211.CLR, dated February 25, 2009. Following the removal of hazards, the WMA Tribe is proposing to have the interior restoration completed so that the building can be used as offices.

The abatement Contractor hired by the WMA Tribe for this project was Spray Systems Environmental (Spray), headquartered in Phoenix, Arizona. Spray's scope of work included the removal of asbestos-containing thermal system insulation (TSI) and piping in the basement boiler room, vinyl floor tile and mastic in hallways, closets, and dormitory rooms, gray transite roof shingles, rolled asphaltic roofing, and roof penetration tar. Door systems, stairs, walls, radiator pipes, toilets, bathtubs, ceramic wall tiles, and window sills in the laundry room tested positive for lead-based paint (LBP). LBP was removed from friction/impact LBP surfaces on door frames, and from stairs. The window sills in the laundry room were removed for disposal. Walls and other LBP components were stabilized for repainting by others at a later date. Lead contaminated soil surrounding the building was removed 6 feet from the perimeter of the building to a 6-inch depth. Bat guano, rodent droppings/urine, and mold were removed inside the building, and substrates biocleaned and encapsulated. Fluorescent light tubes and ballasts were packaged for recycling. Spray's scope was to release a thoroughly biocleaned building free of asbestos, leaded dust, and rodentia waste for post-abatement testing by Tallpines. The work by Spray commenced in late February 2009, and the building was released for reconstruction by Tallpines on June 26, 2009.

To facilitate the removal of hazards, Contract Specifications for this Project were designed by Patty Rubick Luttrell, R.G., C.M.C., Principal, Tallpines. Luttrell is a registered geologist in the State of Arizona (R.G.), a certified microbial consultant (C.M.C); board approved by the American Indoor Air Quality Council, a federally certified AHERA (Asbestos Hazard Emergency Response Act) Project Designer, and an EPA certified Lead Risk Assessor.

1.1 Scope of Work

Tallpines' services for this project included: 1) initial testing and contract design specifications developed for the abatement of hazards, 2) review and approval of the abatement Contractor's medical, respirator fit-tests, and training certificates for currency, 3) review the contract specifications with the Contractor, 4) conduct aggressive air monitoring for asbestos structures, perform wipe sampling for leaded dust on floors, and vacuum dust samples from floors and opened wall cavities to measure for mice allergens following a final biocleaning, 5) ship the samples to Fiberquant Analytical Services and EMLab P&K Laboratories for analyses, 6) conduct 5 additional trips to conduct re-test sampling and to photodocument the work activities, 7) conduct a trip to Phoenix to test the thoroughness of the removal of LBP from doors dipped in chemicals to remove the LBP, and 8) write a closure report documenting the abatement activities and analytical test results, and when the building was released for reconstruction.

1.2 Statement of Qualifications

The industrial hygiene services for this hazard clearance project were conducted by Sharon Lynne and Michael D. Bell, Industrial Hygienists, Tallpines. This report was prepared by Lynne, and edited by Patty Rubick Luttrell, R.G., C.M.C., Principal, Tallpines. These individuals are EPA approved Asbestos Hazard Emergency Response Act (AHERA) Contractor/Supervisors, and Bell is an EPA certified Lead Supervisor. The certificates, current for the dates of fieldwork, can be referenced in the appropriate Appendices.

2.0 ASBESTOS ABATEMENT

2.1 Contractor's Work Practices

Spray's work procedures and engineering controls for asbestos abatement included sealing critical barriers with 2-layers of 6-mil polyethylene (poly) plastic on doors, and windows (glass broken out). Spray used high-efficiency particulate (HEPA) air filtration, HEPA vacuums, decontamination units, amended water prior to and during disturbance, and packaged ACBM waste in labeled, 6-mil poly waste bags. Asbestos-containing vinyl floor tile/black mastic in the dormitory rooms, closets, and hallways was removed manually. Spray used Big-O-Citrus-trip and Envirochem 123 to liquify the mastic which was subsequently wiped clean with disposable cotton rags. Spray workers wore half-face respirators equipped with HEPA filters and disposable Tyvek suits.

Spray used 1K and 2K negative air machines equipped with HEPA filtration during, and following the abatement activities. Tallpines performed pre- and post-abatement visual inspections for the TSI abatement in the basement boiler room, and vinyl floor tile/mastic on the 3 floors of the building. Contaminated waste materials (flooring, TSI glovebags, used Tyvek suits, 6-mil poly plastic, etc.) were loaded out of containment in pre-labeled, 6-mil poly waste bags. Bagged waste was reportedly transported by Spray for disposal at the Apache Junction Landfill in Apache

Junction, Arizona. The photographic log, Appendix A, records some of the removal and sampling activities for the abatement of asbestos, leaded dust, bat guano, rodentia droppings, and mold.

2.2 Air Monitoring

Tallpines collected a total of twenty (20) clearance air samples, and six (6) field blanks for this abatement project. The first air sampling event for the basement boiler room was conducted on April 9. Air monitoring was performed using high-volume *Gast* vacuum air pumps with flow rates recorded between 10.0 and 10.81 liters per minute (lpm). The second air sampling event for the abatement of flooring, was conducted on April 16. Flow rates were recorded between 9.76 and 10.63 lpm. The air sampling trains (TEM air cassettes, plastic tubing, telescoping aluminum stands, and high-volume vacuum air pumps) were field-calibrated prior to each sampling event. End of sampling period flow rates were measured after each sampling event, and the average flow rate was used to calculate the volume of air in liters. Field-calibration of the air sampling trains was performed using a primary *Bios DryCal DCL-H* calibrator. Each recorded flow rate represents the average of ten (10) readings using the *DryCal* primary calibrator.

Air for the high-volume vacuum pumps was drawn through 25-millimeter diameter, mixed-cellulose ester (MCE) membrane filters with a 0.45 micrometer (um) porosity. The transmission electron micro-scope (TEM) filters are supported by a cellulose pad mounted in a carbon-filled polypropylene housing with a 50mm plastic extension cowl.

After the air sampling trains were pre-calibrated and the TEM air cassettes set, Tallpines conducted aggressive air disturbance within the boiler room and within each floor of the building by operating a 280 cubic feet per minute electric blower for 7 minutes per floor. The blower was directed at ceilings, walls, and floors. Tallpines did not use large box fans, but instead relied on the HEPA filtered negative air machines to continuously recirculate the air inside the regulated work areas.

2.3 Laboratory Analysis and Accreditation

The analysis of the TEM cassettes was subcontracted to Fiberquant Analytical Services located in Phoenix, Arizona. Fiberquant uses the AHERA TEM method of analysis; AHERA (Appendix A to Subpart E - Interim Transmission Electron Microscopy Analytical Methods, US EPA 40 CFR Part 763, Mandatory Method) protocols. The TEM air cassette samples were shipped to Fiberquant for a standard 24-hour turn-around-time (TAT) analysis schedule.

Fiberquant has the following federal accreditations: NVLAP Laboratory No. 1031 for PLM bulk sample analysis and TEM air sample analysis; the AIHA Accreditation No. 452 for PCM and metals in air samples; Reference Laboratory, New York State ELAP for PLM asbestos, PCM asbestos, TEM asbestos in air and in water; is an active participant in the AIHA; the Proficiency Analytical Testing (PAT) Program; and the National Institute of Standards and Technology (NIST).

2.4 Regulatory Issues

OSHA has established a PEL (permissible exposure limit) for workers exposed to airborne asbestos fibers in the construction industry [29 CFR (Code of Federal Regulations) 1926.1101]. The OSHA PEL has been established to protect the average worker from health hazards associated with occupational exposure to airborne asbestos fibers during a working lifetime. The abatement Contractor is responsible for conducting personal air monitoring of their workers to document worker protection during the abatement activities. The stationary air sampling trains set by Tallpines following the abatement activities were used to document the performance of the Contractor's engineering controls, and to determine when the regulated work areas could be released.

In 1987, the EPA enacted the Asbestos-Containing Materials in Schools Final Rule (40 CFR 763) to comply with the Asbestos Hazard Emergency Response Act (AHERA). AHERA required the establishment of guidelines for asbestos abatement projects. AHERA addresses the use of appropriate work practices and engineering controls to prevent a release of airborne asbestos fibers outside of the regulated work area. AHERA implemented a clearance standard for re-occupancy of an area following asbestos abatement activities. The clearance standard is currently 0.01 fiber of asbestos per cubic centimeter (f/cc) of air analyzed by phase contrast microscopy (PCM), or <70 structures of asbestos per millimeter squared (str/mm^2) analyzed by TEM. The AHERA standard states that a school may be reoccupied when the average of five (5) air samples having a minimum volume of 1,200 liters is reported at <70 str/mm^2 of asbestos.

2.5 Discussion of Analytical Test Results

Table 1 summarizes the post-abatement air monitoring test results for the building. Because the building was unoccupied during the removal activities, no barrier or negative air exhaust samples were collected for this project. The health & safety meeting sheets, abatement forms, chain-of-custody, and analytical test results for asbestos air monitoring can be referenced in Appendix A.

Post-abatement airborne asbestos structures inside the building are reported at <15 to 17 str/mm^2. Based on the visual inspections and analytical test results, Tallpines authorized release of the building pending successful leaded dust, mouse allergen, and mold test results.

TABLE 1: SUMMARY OF ASBESTOS ANALYTICAL TEST RESULTS
Removal of TSI and Flooring From the Historic B116/Boy's Dormitory

Sample Name	Sample Date	Sample Location	Activity/ Sample Type	TEM (str/mm^2)
09TEC104-01	04/09/09	Field blank	NA/FB	Not Analyzed
09TEC104-02	04/09/09	Field blank	NA/FB	Not Analyzed
09TEC104-03	04/09/09	Basement boiler room, north	NA/CL	17 str/mm^2
09TEC104-04	04/09/09	Basement boiler room, northwest	NA/CL	<17 str/mm^2
09TEC104-05	04/09/09	Basement boiler room, northeast	NA/CL	<17 str/mm^2
09TEC104-06	04/09/09	Basement boiler room, southwest	NA/CL	<15 str/mm^2
09TEC104-07	04/09/09	Basement boiler room, southeast	NA/CL	17 str/mm^2
09TEC104-08	04/16/09	Field blank	NA/FB	Not Analyzed
09TEC104-09	04/16/09	Field blank	NA/FB	Not Analyzed
09TEC104-10	04/16/09	2nd floor, southeast hall	NA/CL	<17 str/mm^2
09TEC104-11	04/16/09	2nd floor, south stairwell	NA/CL	<17 str/mm^2
09TEC104-12	04/16/09	2nd floor, central hall	NA/CL	<17 str/mm^2
09TEC104-13	04/16/09	2nd floor, north hall	NA/CL	<17 str/mm^2
09TEC104-14	04/16/09	2nd floor, northeast hall	NA/CL	<17 str/mm^2
09TEC104-15	04/16/09	Field blank	NA/FB	Not Analyzed
09TEC104-16	04/16/09	Field blank	NA/FB	Not Analyzed
09TEC104-17	04/16/09	1st floor, north central hall	NA/CL	<17 str/mm^2
09TEC104-18	04/16/09	1st floor, north hall	NA/CL	<17 str/mm^2
09TEC104-19	04/16/09	1st floor, central	NA/CL	<17 str/mm^2
09TEC104-20	04/16/09	1st floor, southwest room	NA/CL	<17 str/mm^2
09TEC104-21	04/16/09	1st floor, southeast room	NA/CL	<17 str/mm^2
09TEC104-22	04/16/09	Basement, south room	NA/CL	<17 str/mm^2

TABLE 1: SUMMARY OF ASBESTOS ANALYTICAL TEST RESULTS Removal of TSI and Flooring From the Historic B116/Boy's Dormitory				
Sample Name	**Sample Date**	**Sample Location**	**Activity/ Sample Type**	**TEM (str/mm^2)**
09TEC104-23	04/16/09	Basement, south hallway	NA/CL	<17 str/mm^2
09TEC104-24	04/16/09	Basement, central hallway	NA/CL	<17 str/mm^2
09TEC104-25	04/16/09	Basement, north hallway	NA/CL	<17 str/mm^2
09TEC104-26	04/16/09	Basement, north room	NA/CL	<17 str/mm^2
AHERA Clearance Standard	**AHERA Clearance Standard Using Transmission Electron Microscopy (TEM)**			**<70 str/mm^2**

ACTIVITY NA = No Activity REM = Removal

SAMPLE TYPE FB = Field blank BL = Baseline REM = Remediation WA = Work AreaCL = Clearances

3.0 LEAD-BASED PAINT ABATEMENT

3.1 Contractor's Work Practices

Spray's scope of services for LBP components on the interior and exterior of the building included the stabilization (removal of flaking, chipping LBP, chemical stripping of LBP from door frame impact surfaces, final cleaning, and encapsulation) of LBP present on walls, pipes, and exterior soffit, fascia, and roof trim. LBP on stairwells was removed, and the bare concrete steps were encapsulated. LBP doors were removed and transported to Allison's Furniture in Phoenix for chemical stripping of LBP. Repainting of stabilized walls and stripped doors was not part of Spray's scope of work, but is reportedly to be completed by EPA lead trained workers at the WMA Tribe.

Spray's work practices included HEPA air filtration, Piranha IV and/or Peel Away 7 to strip LBP from door frames/impact surfaces, wet method cleaning using trisodium phosphate (TSI), HEPA vacuums, and LBC (lead barrier coat) to stabilize/encapsulate the LBP.

Spray removed topsoil 6-feet out from the perimeter of the building to a depth of 6-inches. Soil and debris within the concrete areaway were removed and the concrete cleaned by Spray. This was conducted after the stabilization of LBP on exterior soffits, fascia, and roof trim. Following the abatement activities, Spray reportedly transported the hazardous lead waste to U.S. Ecology, a hazardous waste landfill located in Beatty, Nevada.

3.2 Wipe Sampling

Following the post-abatement visual inspections, Tallpines conducted wipe sampling using the following HUD Guidelines sampling protocol:

1) Outline a measured 12" x 12" area with masking tape, 2) don new disposable latex gloves for each sampling event, 3) remove *Ghost Wipe* from package and shake open, 4) pressing down firmly, wipe taped area side-to-side using an S-like motion, 5) fold wipe in-half/dusty side in, 6) wipe sampling area a 2nd time from top-to-bottom using an S-like motion, 7) fold and aseptically insert sample wipe into a new labeled 50 mL polypropylene centrifuge tube, 8) securely cap tube and place sample under chain-of-custody protocol, 9) record time of sampling, and sampling area, and 10) take photographs of representative dust sampling activities. Wipe samples collected from irregularly shaped surfaces such as window sills can be less than 144 in^2 in size, but must be a minimum of 5" x 5" (25 in^2) in total area. The exact dimensions of the sampled areas are to be accurately measured, and recorded on the chain-of-custody for the laboratory.

For purposes of quality assurance, a single (1) unused wipe blank was submitted for analysis for each day of sampling to document if the brand name wipes being used for this project could potentially be contributing to the lead content of the samples. As an example, wipes that contain

aloe vera (succulent cacti grown in soil) can uptake lead and other heavy metals in the soil in concentrations that can be detected by the analytical laboratory.

3.3 Soil Sampling

Tallpines collected a single (1) composite soil sample from the exterior perimeter soil. The soil sample was collected from bare soil surrounding the building, and placed in a pre-labeled 50mL polypropylene centrifuge sample tube. The tube was tightly secured, and placed under chain-of-custody protocol for shipping to the laboratory.

3.4 Laboratory Analysis and Accreditation

Analytical analysis of the wipe and soil samples was subcontracted to Fiberquant in Phoenix, Arizona. Fiberquant uses a flame atomic absorption spectrometer (AAS) for lead analysis using modified NIOSH Method 7082 for wipes, and modified SW Method 3050b for extraction/digestion of soil, and flame atomic absorption/direct aspiration SW Method 7420 for soil. Samples were shipped to Fiberquant and analyzed on a standard 2-3 day TAT analysis schedule.

Fiberquant has the following federal accreditations: Participates in the Environmental Lead Proficiency analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for analyzing environmental lead samples, and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of lead.

3.5 Discussion of the Analytical Test Results

The EPA HUD clearance standards, current for the dates of analysis, and used to determine the thoroughness of the abatement of lead hazards, and if the building is currently safe for release, are:

Floors	40 ug/ft^2	(100 micrograms per square foot)
Interior window sills	250 ug/ft^2	
Soil	2,000 ppm, and 400 ppm in a play area or bare soil	

During the initial post-abatement visual inspection conducted on April 16th, 2009, Tallpines observed residual LBP debris on concrete floors, window sills, stairwell components, and pipes. The LBP window sills in the basement laundry room had not been removed for disposal. The analytical test results were reported with elevated lead counts in the basement, 2nd floor, and stairwells. Spray was requested to reclean the basement, stairwells, and 2nd floor.

1st Re-Test (April 28th)

Following a recleaning by Spray, Tallpines conducted a 2nd visual inspection and collected additional wipe samples. Following the 1st re-test, the 2nd floor leaded dust samples B116-32 through -40 were reported below the HUD clearance level of 40 ug/ft^2, but the basement, stair-

wells, and basement coal room measured elevated leaded dust counts. Tallpines requested that these areas inside the building remain restricted until additional cleaning and re-testing could be completed.

2nd Re-Test (May 5th)

Following a reported recleaning, Tallpines returned on May 5th to resample the basement floor, basement coal room, and stairwell components. The 2nd round of analytical test results are reported with elevated leaded dust counts in the basement and stairwells. Coal room dust sample B116-61 is reported with 33 ug/ft^2 which is below the HUD clearance standard of 40 ug/ft^2 for floors. Tallpines authorized release of the coal room, but requested that the basement floors and stairwells be recleaned and access restricted until additional re-testing could be completed.

3rd Re-Test (May 14th)

Following a reported recleaning, Tallpines returned on May 14th to conduct a 3rd round of sampling on the basement floor and stairwells. Wipe samples were reported with <7.5 ug/ft^2, or below the laboratory detection limit for lead, with the exception of wipe sample B116-71. Collected on the north stairwell landing, it is reported with a leaded dust concentration of 260 ug/ft^2 which exceeds the EPA HUD clearance standard of 40 ug/ft^2 for floors. Tallpines requested that the stairwell landing be recleaned and thoroughly encapsulated, and that access remain restricted until the stairwell could be re-tested for leaded dust.

4th Re-Test (June 8th)

During the reinspection conducted on June 8th, Tallpines observed that the stairwell landing did not appear to have been recleaned or encapsulated. Dust sample B116-72, collected on the north stairwell landing, is reported with a leaded dust concentration of 560 ug/ft^2 which exceeds the EPA HUD clearance standard of 40 ug/ft^2 for floors. Tallpines requested that the stairwell landing be recleaned and thoroughly encapsulated, and that access remain restricted until the stairwell could be re-tested for leaded dust.

5th Re-Test (June 22nd)

During the 5th reinspection, Tallpines noted that white encapsulant paint had been applied to the landing and stair treads. The landing appeared to be thoroughly encapsulated and clean. Dust sample B116-73, collected on the north stairwell landing, is reported with a leaded dust concentration of <7.5 ug/ft^2, or below the laboratory detection limit for leaded dust. Based on the visual reinspection and analytical test results, Tallpines authorized release of the northeast stairwell.

3.6 Off-Site Chemical Dipping of LBP Doors

On April 1st, Spray transported the LBP wooden doors removed from the dormitory to Allison's Furniture located in Phoenix. Spray subcontracted Allison's to chemically remove the LBP from the doors. On April 10th, Tallpines conducted a visual assessment of the dipped doors, and measured lead levels using an XRF analyzer as well as wipe samples which were sent to Fiber-quant Analytical for analysis. The XRF analysis, and the laboratory analysis both revealed residual elevated lead counts on the dipped doors. Elevated XRF readings for lead were measured on the tops and bottoms of the doors (parallel to wood grain), but not on the surface of the doors. This demonstrates that lead in the methylene chloride tank is being absorbed by the more porous portions of the wood grain. In a discussion with the EPA, it was decided that the doors should not be reinstalled inside the building unless they were encapsulated so that no LBP could be released from impact/friction surfaces.

Tallpines' EPA lead certificates, email correspondence regarding this project, post-abatement visual inspection sheets, chain-of-custody, and analytical test results for leaded dust and soil sampling, can be referenced in Appendix B.

4.0 MOUSE ALLERGEN BIOREMEDIATION

4.1 Contractor's Work Practices

Spray's scope of services for this project included the removal of bat guano and rodentia droppings/urine from inside the attic, interior of the building, and opened wall systems. Droppings were misted with Quat-128, an antimicrobial disinfectant prior to being bagged. Spray used alcohol pads and benzalkonium chloride solution to bioclean surfaces following removal and bagging of biowaste. Final cleaning involved HEPA vacuums and wet wiping. The attic was encapsulated with a penetrating white encapsulant following the biocleaning activities.

4.2 Testing for Mouse Allergens

Mouse allergens, known to cause allergic reactions in humans, are present in rodentia urine and skin flakes. Because of the close association of droppings to urine, a thorough biocleaning is usually sufficient in removing urine from a substrate. If the substrate is porous, a thorough biocleaning is not always successful, so analytical testing is the only way to document the thoroughness of the removal. To test for mouse allergens, Tallpines vacuumed an approximate 1 ounce of dust from biocleaned floors and opened wall cavities previously littered with droppings and urine stains. A noncompliant background sample of dust was collected to use as a basis of comparison to that of complaint locations. The vacuumed dust samples were labeled, and shipped to the laboratory using chain-of-custody protocol.

4.3 Laboratory Analysis and Accreditation

Analysis of the samples was subcontracted to EMLab/P&K Laboratories, Inc. (EMLab) located in Phoenix, Arizona. EMLab analyzes allergens using the Quantitative Enzyme-Linked ImmunoSorbent Assay (ELISA) computer program. Sensitivity to indoor allergens has been shown to play a major role in the sensitization of individuals which can trigger asthma. The sources of rodent allergens include urine and skin flakes. The urine has a high percentage of protein which is the primary allergen to humans. As the urine dries, the proteins become airborne and when inhaled by humans, can result in an allergic reaction.

The dust samples were shipped to EMLab using Federal Express, and analyzed on a standard 10-day TAT schedule. EMLab is a state-of-the-industry laboratory dedicated to the research and development of IAQ testing, and is one of the largest IAQ microbial testing laboratories in the world. EMLab is inspected, licensed, and/or proficiency tested by the Arizona Department of Health Services (ADHS), the Food and Drug Administration (FDA), the United States Department of Agriculture (USDA), the American Industrial Hygiene Association (AIHA), and participates in the AIHA Environmental Microbiology Proficiency Testing Program (EMPAT Lab No. 102297). EMLab is accredited by the American Association for Laboratory Accreditation (A2LA), one of the most rigorous accreditations which can be held by a microbial testing laboratory.

4.4 Discussion of the Analytical Test Results

On April 16th, Tallpines collected twenty (20) dust samples for mouse allergens inside the building. The dust samples were reported with allergens between <0.039 (less than the laboratory detection limit) to 0.49 micrograms per 0.1 gram (mcg/g) of dust. Dust sample 09TEC104-15, collected inside the 1st floor southwest room M-3, is reported with 1.83 mcg/g which exceeds the mouse allergen threshold value of 1.6 mcg/gm. Based on the analytical test results, Tallpines requested that Spray reclean Room M-3 prior to conducting an additional test for allergens.

1st Re-Test (April 29th)

On April 29th, Tallpines return to re-test the 1st floor southwest Room M-3 and the basement boiler coal room (not previously cleaned or tested). Tallpines collected two (2) dust samples and a single (1) background sample. The dust samples are reported with mouse allergens between <0.039 and 0.54 mcg/g, which are below the mouse allergen threshold value of 1.6 mcg/gm.

The post-cleaning visual inspection sheets, chain-of-custody, and analytical test results, can be referenced in Appendix C.

5.0 MICROBIAL TESTING

5.1 Contractor's Work Practices

Spray's scope of services for this portion of the project included the removal of mold contaminated building materials present inside the attic, 2nd floor Rooms 2-7, 2-8 and 2-9 (location of portico roof damage impacting 2nd floor ceiling components), and the basement southwest and northwest rooms adjoining the recreation rooms. Contaminated areas were misted with Quat-128, an anti-microbial disinfectant prior to bagging contaminated materials. Spray used alcohol pads and benz-alkonium chloride solution to bioclean surfaces following removal and bagging of mold. Final cleaning involved HEPA vacuums and wet wiping. The attic was encapsulated with a penetrating white encapsulant following the biocleaning activities.

5.2 Background on Microbial Contamination

Microbial organisms prefer moist, dark locations (wall cavities, beneath carpet or other flooring, covered roof systems) with a moisture source (plumbing leaks, capillary action from the soil, vapor diffusion through perimeter/exterior walls, air-conditioner condensate pans, evaporative cooler reservoirs, condensation in bathrooms or laundry rooms with inadequate exhaust vents, rain, snow, and flooding). Common nutrient sources for microbial contaminants include drywall backing, wood, cellulose ceiling tiles, carpet, and fiberglass insulation. Light and circulating air have a tendency to dry materials, making it inhospitable for fungal growth. Unchecked microbial growth in the indoor environment can result in the destruction of the nutrient substrate, as well as a range of adverse health effects for occupants unknowingly exposed to microbial contamination.

5.3 Laboratory Analysis and Accreditation

Analysis of the surface swab samples was subcontracted to EMLab located in Phoenix, Arizona. EMLab analyzes swab samples using light microscopy at a 600X magnification with the entire slide (100% of the sample) being analyzed, and results reported as counts per square centimeter. The samples were shipped to EMLab using Federal Express, and analyzed on a standard 3-day schedule.

5.4 Discussion of the Analytical Test Results

On April 16th, Tallpines collected two (2) swab samples to test for mold in areas with visible residual stains.

Post-remediation swab sample 09TEC104-01, collected from the 2nd floor Room 2-7 west window sill, is reported with a fungal spore count of 22 counts per square centimeter (c/cm^2). Reported genera of fungal mold includes 18 c/cm^2 of Ascospores, and 3.1 c/cm^2 of *Penicillium/Aspergillus*. The term Ascospores refers to the amalgamation of similarly-shaped, unidentifiable

spores classified as allergens; the ability to induce an allergic response in humans. *Penicillium/Aspergillus* have the ability to produce mycotoxins (stable chemical toxins produced by fungal mold), and are of concern when measured in elevated counts in the indoor environment. The mold spore population (types and counts) measured on the 2nd floor Room 2-7 window sill does not represent an elevated count.

Post-remediation swab sample 09TEC104-22, collected from the basement recreation room southwest room divider wall, is reported with a fungal spore count of 21,000 c/cm^2. Reported genera of fungal mold includes 6,800 c/cm^2 of *Chaetomium*, 9,200 c/cm^2 of *Penicillium/Aspergillus*, and 5,400 c/cm^2 of *Stachybotrys*. *Chaetomium* and *Stachybotrys* have the ability to produce mycotoxins, and are of concern when measured in elevated counts in the indoor environment. The mold spore population measured on the basement southwest room divider wall is elevated, and warrants removal of contaminated materials at this location. Tallpines requested that Spray conduct additional work at this location.

1st Visual Re-Inspection (April 28th)

On April 28th, Tallpines returned to visually re-inspect the basement south recreation room southwest room divider wall. Spray had removed the mold contaminated building materials, and applied a layer of encapsulant paint to the opened wall cavities and surrounding plaster wall systems. Tallpines noted no residual mold contamination.

2nd Visual Re-Inspection (May 14th)

Tallpines noted mold contamination still present inside the basement northwest room wall divider attached to the north recreation room, and requested that Spray remove the contaminated building materials, bioclean, and encapsulate.

3rd Visual Re-Inspection (June 22nd)

On June 22nd, Tallpines returned to visually re-inspect the basement north recreation northwest room divider wall. Spray had removed the mold contaminated building materials on the north side of the divider wall. No encapsulant had been applied to the opened wall cavity or surrounding plaster wall systems. Tallpines noted no visible mold contamination, but water staining is visible on the remaining wood panel divider wall. The chain-of-custody and analytical test results, can be referenced in Appendix C.

On June 26, 2009, Tallpines authorized release of the building back to the WMA Tribe following receipt of successful asbestos, leaded dust, mouse allergen, and mold analytical test results.

6.0 RECOMMENDATIONS

Following the complete renovation/reconstruction of the building, Tallpines recommends that the White Mountain Apache Tribe use their EPA lead licensed workers and Contractor/Supervisor to conduct a thorough biocleaning throughout the building prior to reoccupancy. Wet wiping with Quat-128 and HEPA vacuuming will remove any potential release of leaded dust and mouse droppings/urine which may have accumulated due to the construction activities, and to the building being unoccupied. This should be completed before carpet, drapes, and/or furnishings are installed inside the finished building.

Tallpines recommends that the White Mountain Apache Tribe maintain this report in a permanent, secured file to document activities regarding the removal of hazards, release of the building for reconstruction, and recommendations for biocleaning prior to reoccupancy of the building. Tallpines appreciates the opportunity to have assisted the Tribe on this indoor air quality hazard removal project. This completes Tallpines' scope of services.

Respectfully Submitted,
Tallpines Environmental Consulting Co.

REGISTERED GEOLOGIST
CERTIFICATE NO.
28248
PATTY RUBICK
LUTTRELL
Date Signed 08/22/09
ARIZONA, U.S.A.
EXPIRES 09/30/09

Patty Rubick Luttrell, R.G., C.M.C.
Principal and Certified Microbial Consultant

Prepared by:

Sharon Lynne
Industrial Hygienist

Addressee: (4) bound reports

APPENDIX A
CERTIFICATES, PHOTOGRAPHIC LOG, ASBESTOS PAPERWORK

E 2279

THE ASBESTOS INSTITUTE

Certifies that

Sharon Lynne

has attended the EPA approved course

AHERA Refresher
Contractor/Supervisor
March 5, 2009

and successfully passed the competency exam.

Date of Examination: **March 5, 2009**

Date of Expiration: **March 5, 2010**

Director

Approved Instructor

THE ASBESTOS INSTITUTE
8102 North 23rd Avenue
Suite A
Phoenix, AZ 85021-4962
602-864-6564

This training meets all requirements for asbestos accreditation under TSCA Title II.

D 12585

THE ASBESTOS INSTITUTE

Certifies that

Michael D Bell

has attended the EPA approved course

AHERA Refresher
Contractor/Supervisor
June 26, 2008

and successfully passed the competency exam.

Date of Examination: **June 26, 2008**

Date of Expiration: **June 26, 2009**

Director

Approved Instructor

THE ASBESTOS INSTITUTE
8102 North 23rd Avenue
Suite A
Phoenix, AZ 85021-4962
602-864-6564

This training meets all requirements for asbestos accreditation under TSCA Title II.

SCS Engineers

Certificate of Refresher Training for Asbestos Abatement Project Designer

This is to certify that the following individual has been re-trained, examined, and is hereby re-accredited in accordance with OSHA regulations (29 CFR 1910.1001 and 1926.1101) and EPA regulations (40 CFR 763 and 40 CFR 61 M) and TSCA Title II.

Patty Luttrell

SCS Engineers
3460 West Cheyenne, Suite 100
North Las Vegas, NV 89032
(702) 645-1521

Training Date: December 8, 2008
Expiration Date: December 8, 2009
Certificate Number: PDR-08-004
Instructor: Kenneth Ray
Signature:

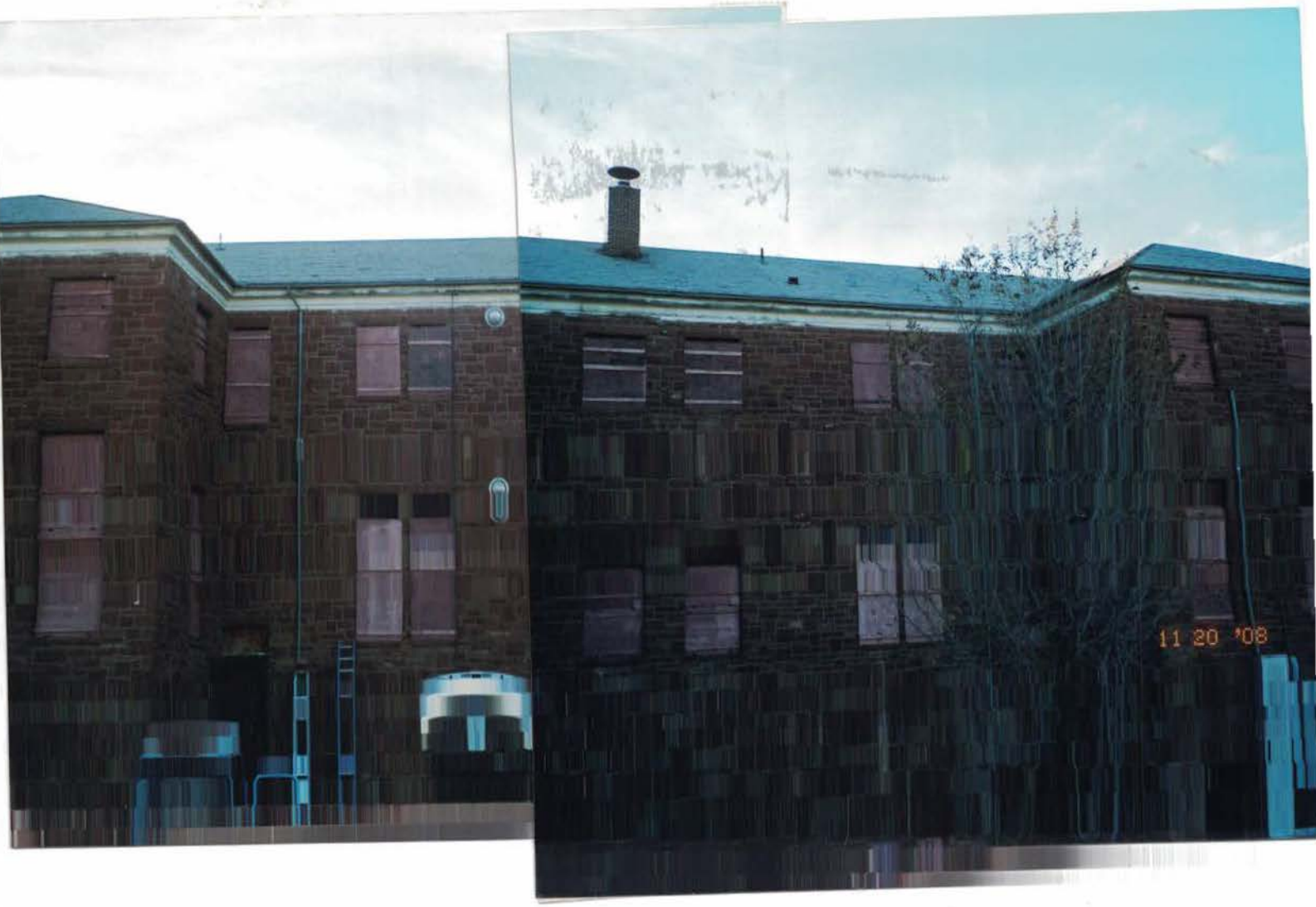


Photo #1: Partial overview of the historic B116/Boy's Dormitory located in the White Mountain Apache Tribe Historic District in Fort Apache, Arizona (the Site). Spray Systems Environmental (Spray), the abatement Contractor, removed hazards consisting of asbestos, lead-based paint (LBP), rodent droppings, bat guano, mold, and universal waste. Viewing west.

Photo #3: Water-damage from roof leaks are visible inside the attic on the wooden plank sheathing, and wooden roof trusses. White bat guano is present on roof framing (arrows), and on the attic floor. Viewing up, and to the northeast.

Photo #4: Copious amounts of rodent droppings cover the entire attic floor, and are up to 6-inches deep in some locations. Drywall debris, construction debris, and fiberglass insulation inside the attic have to be bagged and removed prior to biocleaning. Viewing down, and to the north.

Photo #5: Water-damage on the portico roof has resulted in buckling of the wooden ceiling, and deterioration of structural components. The portico roof drains eastward toward the main roof, and is not equipped with scuppers or gutters. Viewing up, and to the northeast.

Photo #6: Inside the attic at the location of the portico roof, there is water-damage, structural damage, staining, and mold contamination. Swab sample 08TEC304-01 is reported with elevated counts of fungal mold that warrants removal of contaminated materials. Viewing west.

Photo #7: Swab sample -09, collected on the water-damaged plaster ceiling inside the 1st floor restroom, is reported with 49,000 counts per square centimeter (c/cm^2) of *Stachybotrys. Stachybotrys* has the ability to produce mycotoxins (stable chemical toxins produced by fungal mold), and is of concern when measured in elevated counts in the indoor environment. Removal of contaminated materials is warranted. Viewing up, and to the southwest.

Photo #8:
Lead based paint (LBP) is present on interior walls and stairwells inside the dormitory. Using an XRF analyzer, the red paint on the stair treads is reported with a lead content of 9.3 milligrams per square centimeter (mg/cm^2). The hand rails, rails, and posts are not LBP. Viewing northwest inside the 1st floor southeast entry stairwell.

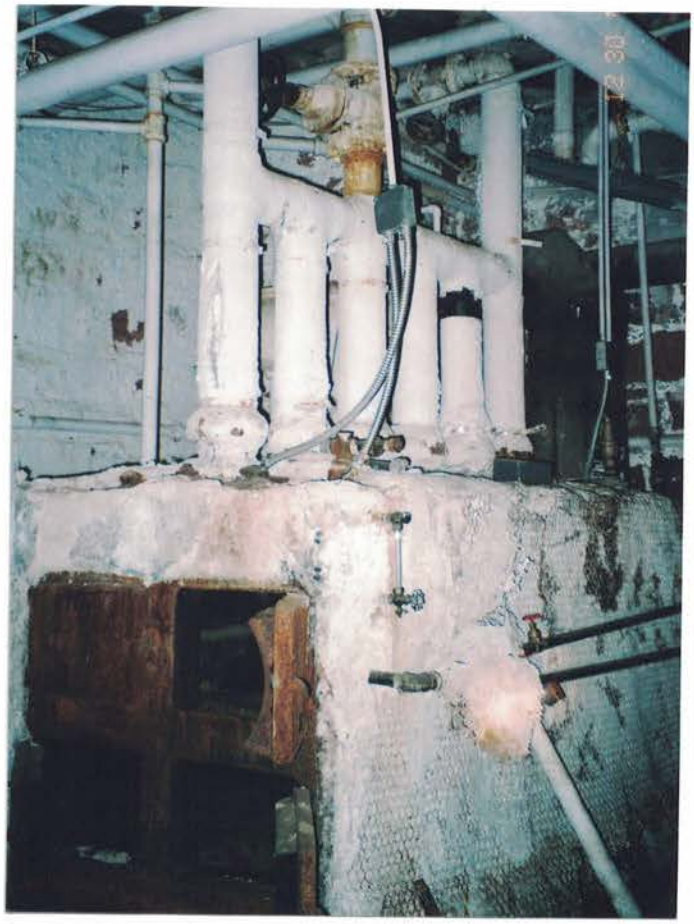


Photo #9:
Asbestos-containing thermal system insulation (TSI) is present on the boiler inside the basement boiler room. Significantly damaged TSI is visible on the side of the boiler, and on the dirt covered concrete floor inside the boiler room. Viewing northwest.

Photo #10: Composite soil sample B116-02L was collected from the perimeter of the building to determine if the soil surrounding the dormitory is contaminated with lead. Soil sample -02L is reported with 5,300 milligrams per kilogram (mg/kg), or parts per million (ppm), which exceeds the HUD clearance level of 400 ppm for bare soil. Viewing down.

Photo #11: Spray erected a temporary chain-link fence around the building for the duration of the abatement of hazards. The entire building became the regulated work area (requires a respirator and protective clothing to enter). Viewing northwest.

Photo #12: General construction debris, carpet, furnishings, and trash were loaded out of the building prior to the removal of hazards, and disposed of as nonhazardous waste into 40-yard waste bins located at the site. Viewing down.

Photo #13: Spray used wet methods to remove LBP doors for off-site stripping of LBP. Water sprayed on the components minimized leaded dust, mold spores, and mouse allergens from becoming aerosolized during the cleanup activities. Viewing down, and to the north inside the basement.

Photo #14:
The front entry to the building has peeling LBP on the walls, and asbestos-containing vinyl floor tile/black mastic in the entry and hallways. Minor amounts of debris are still visible inside the building. Spray will begin the abatement activities following debris removal. Viewing southwest.

Photo #15: Spray workers constructed critical barriers consisting of 6-mil polyethylene (poly) plastic around windows, doors, and HVAC registers to maintain a negative air pressure differential inside the building during the abatement activities. Viewing north.

Photo #16: Carpet was cut and removed by Spray workers. Note that the personal protective equipment (PPE) donned by the Spray workers consists of high-efficiency particulate air (HEPA) filtered respirators, disposable Tyvek suits, hardhats, and gloves. The carpet was disposed of as nonhazardous solid waste. Viewing down, and to the northwest.

Photo #17:
The metal lath and plaster ceiling was partially removed on the 2nd floor of the dormitory to aid in the removal of bat guano and rodent droppings present inside the overlying attic. Spray wet the waste and shoveled it through the ceiling to the 2nd floor before bagging it into 6-mil poly waste bags for disposal. Viewing up, and to the southwest.

Photo #18: Bat guano, contained within a 6-mil poly waste bag, was shoveled from the floor of the attic. Note that the asbestos-containing 12" x 12" vinyl floor tile/black mastic has not yet been abated. Viewing down.

Photo #19: Bagged carpet waste, contained in 6-mil poly waste bags, was removed from the 1st and 2nd floors, and from the full-basement. Viewing down, and to the south-east.

Photo #20: Spray lined a front-loading waste bin with 2-layers of 6-mil poly plastic. Asbestos-containing building materials will be loaded into 6-mil poly waste bags before being transported to the Apache Junction Landfill in Apache Junction, Arizona. Viewing northeast.

Photo #21:
Spray constructed a single chambered decontamination unit at the southeast entry to the 1st floor. DANGER ASBESTOS signage is posted to be in compliance with the OSHA communication of hazards standard. Note that the red stairs are LBP, but not the railings or posts. Viewing up, and to the southwest.

Photo #22:
Spray used 6-mil poly to restrict access to the northeast entry to the 1st floor during the asbestos abatement of vinyl floor tile/black mastic. A clear plastic window was installed to allow viewing of the abatement activities. Viewing up, and to the southwest.

Photo #23: Spray manually scraped loose and flaking LBP to stabilize interior walls for repainting by others. Paint chips were allowed to fall to the floor before being bagged as hazardous waste. Note the Spray worker on the left spraying water into the dormitory rooms to minimize leaded dust from becoming aerosolized during the stabilization activities. Viewing northwest.

Photo #24: HEPA-filtered 2,000 cubic feet per minute (CFM) negative air machines were used during and following the abatement activities. Filtered air was exhausted to the exterior of the building through 6-mil poly tubing. Viewing east inside a side hallway.

Photo #25:
Spray erected a three stage wet decontamination (decon) unit at the southeast entry to the building. Bilingual CAUTION LEAD HAZARD signage was posted at the entry to the decon. Viewing southwest.

Photo #26: Spray used BIG-O CITRUSTRIP to remove asbestos-containing black mastic from the concrete floors. Note the thoroughness of the mastic removal on the recently stripped concrete floor beneath the industrial strength solvent. Viewing down.

Photo #27: Spray workers apply a paint stripper to LBP on friction and impact surfaces at the location of a removed door system. Workers applied the stripper with a paint brush before manually scraping it off with a chisel. Viewing southeast.

Photo #28: Spray used PEEL AWAY 7, a paint remover, on friction and impact surfaces before scraping off the paint. Viewing down.

Photo #29: Spray applied 6-mil critical barriers over the main entry to the building. A white encapsulant paint was applied to the wall systems after loose and flaking LBP paint was manually scraped off the walls. Spray bagged the LBP debris and used a HEPA vacuum to clean before washing and encapsulating the walls. Viewing west.

Photo #30: Loose and flaking paint was scraped, cleaned, and encapsulated in order to stabilize the LBP walls for repainting by others. Viewing southwest.

Photo #31: A three stage wet decon unit was erected at the entry to the basement boiler room. Bilingual DANGER ASBESTOS signage was posted at the entry to the regulated work area. Because the basement has a separate entry not open to the rest of the building, a separate containment was constructed. Viewing down, and to the south.

Photo #32: Post-abatement clearance air samples, collected inside the boiler room, are reported <17 structures per square millimeter (str/mm^2) of asbestos which is well below the AHERA clearance standard of <70 str/mm^2. Following the stripping of TSI, the boiler was removed for recycling of the metal. Compare this to photograph #9. Viewing north.

Photo #33: TSI boiler insulation was removed from the hot water tank, and TSI pipe insulation was removed from the pipes. Note that turquoise duct tape was used to cover open ends of pipes to prevent potential contamination from asbestos fibers. Viewing southwest.

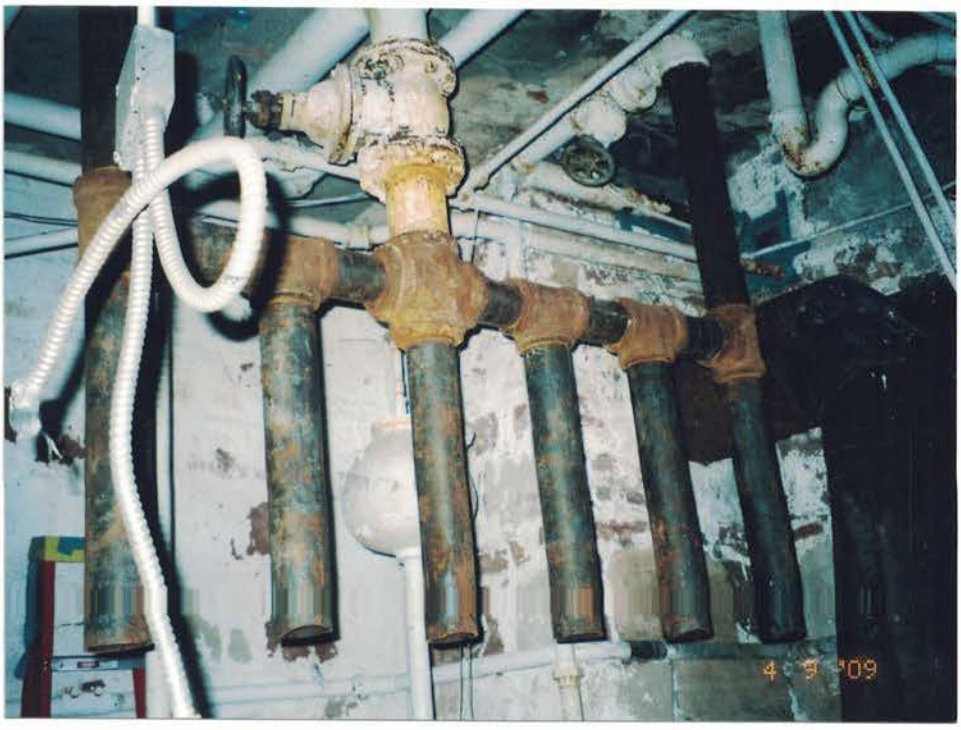


Photo #35: TSI from the boiler pipes was removed and the area cleaned prior to the cutting of the metal pipes, and removal of the boiler. Note the thoroughness of the removal. Viewing up, and to the northwest.

Photo #36: After removing the boiler, Spray sealed the exposed hole in the concrete floor with plywood, 6-mil poly plastic, and duct tape. Spray thoroughly cleaned the concrete slab foundation of TSI debris and soil prior to air monitoring conducted by Tallpines. Viewing northwest.

Photo #37:
Loose and flaking LBP was manually scraped from wall systems, wet wiped, and encapsulated with *22-P*, a lockdown encapsulant paint. Tallpines conducted wipe sampling of dust on floors to document the thoroughness of the removal of leaded dust from the interior of the building. Viewing up, and to the west.

Photo #39: Post-abatement wipe sample B116-14, collected from the concrete floor inside 1st floor Room M-4, is reported with a lead content of 23 micrograms per square foot (ug/ft^2) which is below the HUD clearance standard of 40 ug/ft^2 for floors. Viewing down.

Photo #40: Post-abatement wipe sample B116-21, collected from the 2nd floor south stairwell stair tread, is reported with 170 ug/ft^2 which warrants additional cleaning by Spray. As per the HUD regulations, the entire concrete stairway must be recleaned. Viewing down, and to the east.

Photo #41: Spray conducted a thorough cleaning of the building by wet wiping, HEPA vacuuming, and application of a white encapsulant in order to minimize leaded dust. Note that the walls, stairs, and concrete floor inside the southwest portion of the south recreation room have been thoroughly cleaned. Viewing southwest.

Photo #42: Inside the attic, rodent droppings, bat guano, fiberglass insulation, and building materials were thoroughly removed. Spray used *Quat 128* and bleach to bioclean the wall and floor systems inside the attic prior to the application of a light layer of encapsulant. Viewing down, and to the north.

Photo #43: During the post-remediation visual inspection for biohazards, Tallpines noted minor amounts of rodent droppings missed by the Spray crew. Spray workers immediately HEPA vacuumed and biocleaned this portion of the metal lath & plaster floor. Viewing down, and to the southwest.

Photo #44: Spray workers scraped bat guano off the attic trusses and framing, biocleaned, and applied a light layer of encapsulant. Water stains are visible on a section of the attic trusses beneath the encapsulant. Viewing south.

Photo #45: Post-remediation dust sample 09TEC104-09, collected from the 2nd floor Room 2-8 northwest closet, is reported with < 0.039 micrograms per gram (mg/g) of mouse allergens which is well below the threshold value of 1.6 mg/g. Based on the visual, Tallpines requested that Spray reclean the closet. Viewing down, and to the northwest.

Photo #46: Post-remediation dust sample 09TEC104-16, collected inside the 1st floor Room M-1 north closet, is reported with 0.49 mg/g of mouse allergens. Droppings are still inside the wall cavities, but based on the analytical test results, do not represent a current hazard. Viewing down, and to the northwest.

Photo #47: One of hazards removed by Spray from Building 116 was mold. Post-remediation swab sample 09TEC104-01, collected from the 2nd floor Room 2-7 west window sill, is reported with a nonelevated count of fungal mold. Viewing down, and to the west.

Photo #48: Swab sample 09TEC104-22, collected from visible mold on the south recreation room southwest wall, is reported with a total spore count of 21,000 c/cm^2 which warrants additional work by Spray at this location. Viewing southwest.

Photo #49: Post-abatement air sample 09TEC104-19, collected in the central portion of the 1st floor near the main entry, is reported with an airborne count of <17 str/mm^2 of asbestos which is well below the AHERA clearance standard of <70 str/mm^2. Note the thorough layer of encapsulant on the concrete floor following the removal of asbestos-containing vinyl floor tile and black mastic. Viewing northwest.

Photo #50:
Post-abatement air sample 09TEC104-12, collected inside the 2nd floor central hallway, is reported with <17 str/mm^2, or below the laboratory detection limit for asbestos. Viewing north.

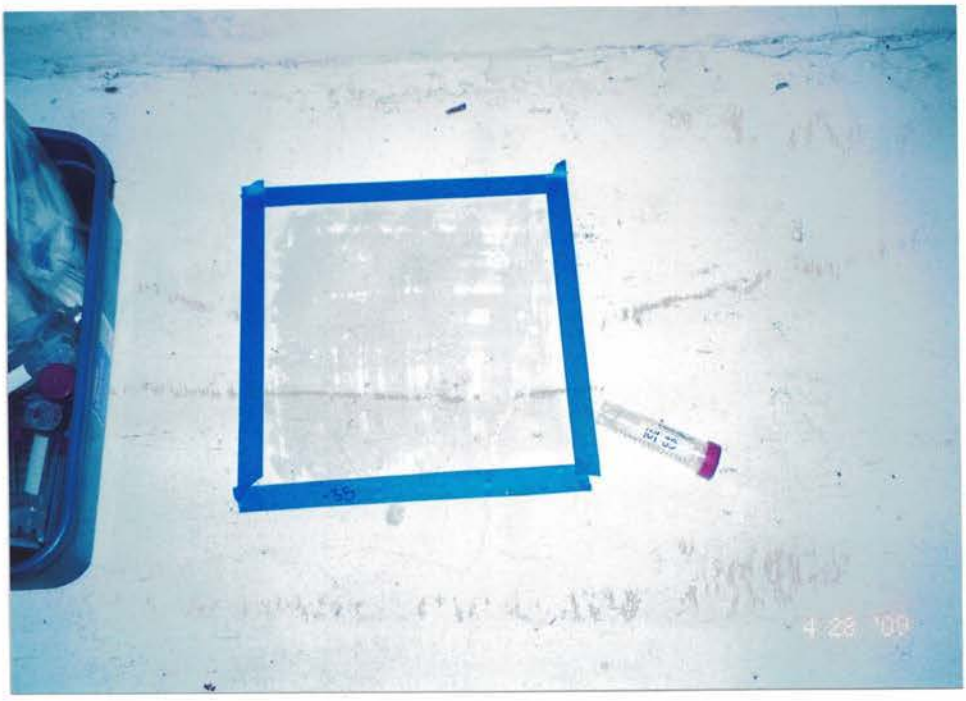


Photo #51: Post-abatement wipe sample B116-35, collected on the central portion of the basement hall floor, is reported with a total lead count of 160 ug/ft^2 which is elevated above the HUD clearance standard of 40 ug/ft^2 for floors. Note the thoroughness of the white encapsulant applied to the concrete floor. Viewing down.

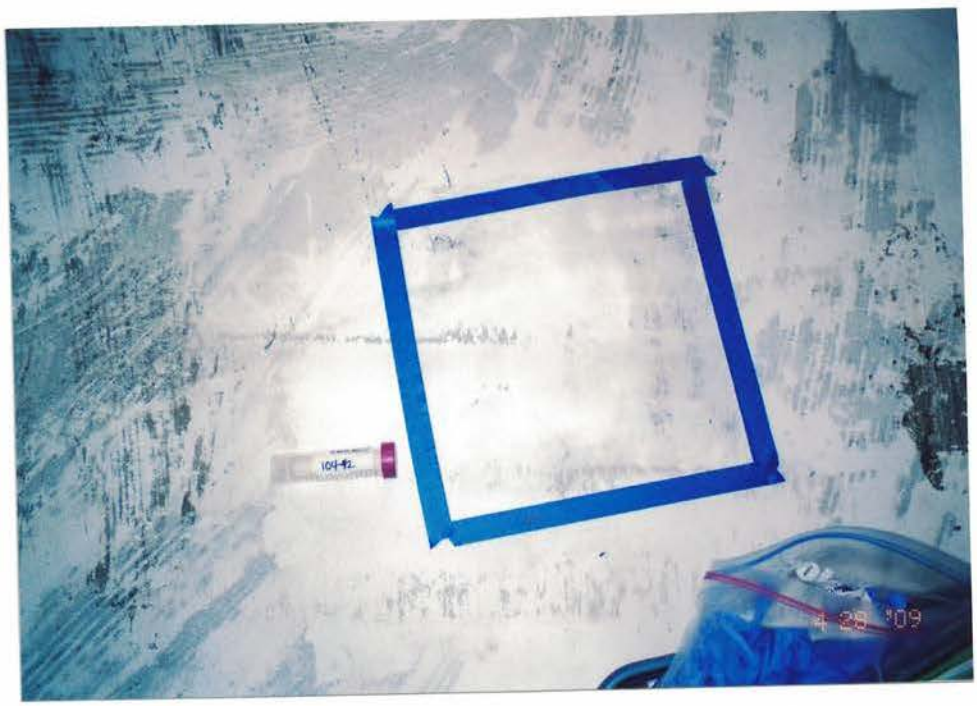


Photo #52: Post-abatement wipe sample B116-42, collected from the 2nd floor Room 2-13 central floor, is reported with a total lead count of 9.5 ug/ft^2 which is below the HUD clearance standard of 40 ug/ft^2 for floors. Viewing down.

Photo #53: Composite soil sample B116-51, collected from topsoil following the removal of lead-contaminated soil surrounding the building, is reported with a lead count of 140 ppm which is below the HUD clearance standard of 400 ppm for bare soil. Spray removed topsoil to a depth of 6-inches in a 6 foot radius around the perimeter of the building. Viewing down.

Photo #54:
During the removal of topsoil, Spray removed soil inside the concrete areaway which flanks the basement (a small sunken area allowing access, or light and air to basement doors and/or windows). Soil and debris had clogged the floor drains which subsequently flooded the basement rooms more than once during the occupancy of the building. Viewing down, and to the west.

Photo #55: Stormwater debris visible inside the metal floor drain in the concrete areaway following a recent storm. Installation of wire screens, and routine maintenance of the floor drains will be mandatory to prevent future flooding in the basement. Viewing down.

Photo #56: Inside the basement south recreation room, Spray removed mold contaminated wall systems inside the southwest rooms. Note that an approximate 4-foot height of drywall has been removed at this location. Viewing southwest.

Photo #57: Post-abatement wipe sample B116-54, collected from the basement laundry room floor, is reported with a total lead count of 180 ug/ft^2 of leaded dust which is elevated, and warrants additional cleaning by Spray. Note the visible dark red paint on the concrete after the wipe sample was collected. Viewing down.

Photo #58: A LBP window sill inside the basement laundry room was removed for disposal as per the contract specifications. The LBP wooden sill is not historical, and warrants removal and disposal instead of stripping in-place. Viewing down, and to the southeast.

Photo #59: Temporary stockpiling of interior LBP doors which were transported to Allison's Furniture in Phoenix. The doors were chemically stripped of LBP. Viewing southeast inside the south recreation room.

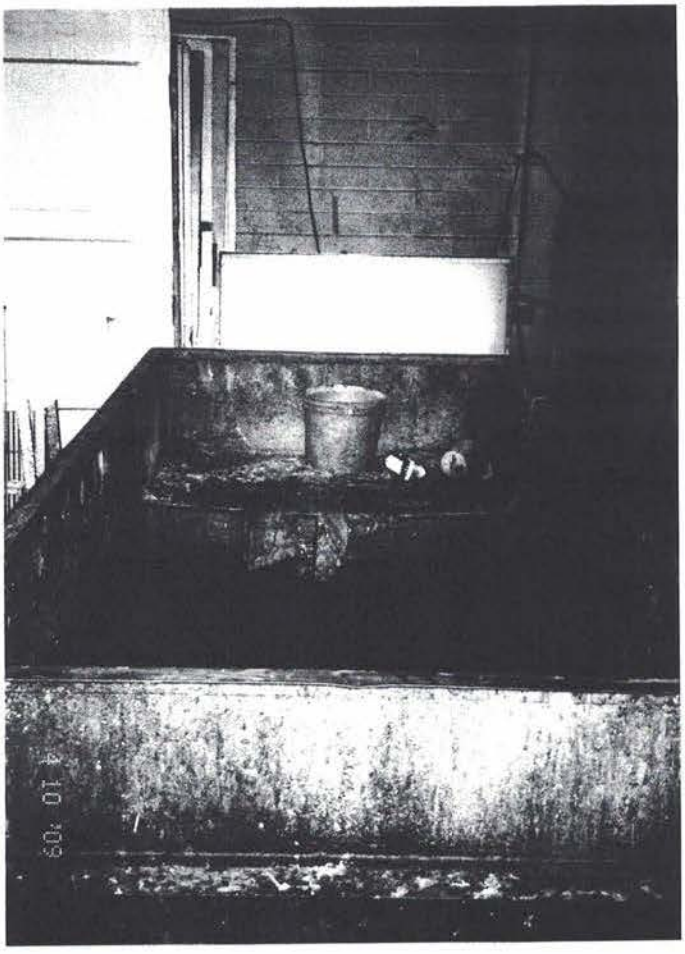


Photo #60:
Inside Allison's Furniture warehouse, a tank of methylene chloride is used to dip wooden components coated with LBP. Tallpines noted no designated exhaust for leaded dust, or volatile organic compounds (VOCs) in the vicinity of the dip tank. Viewing down.

Photo #61: Following the stripping of wooden doors, Tallpines spot-checked the lead content of the doors using an x-ray fluorescence (XRF) analyzer. Elevated XRF readings for lead were measured on the tops and bottoms of doors (parallel to wood grain), but not on the surface of the doors. This demonstrates that lead in the methylene chloride tank is being absorbed by the more porous portions of the wood grain.

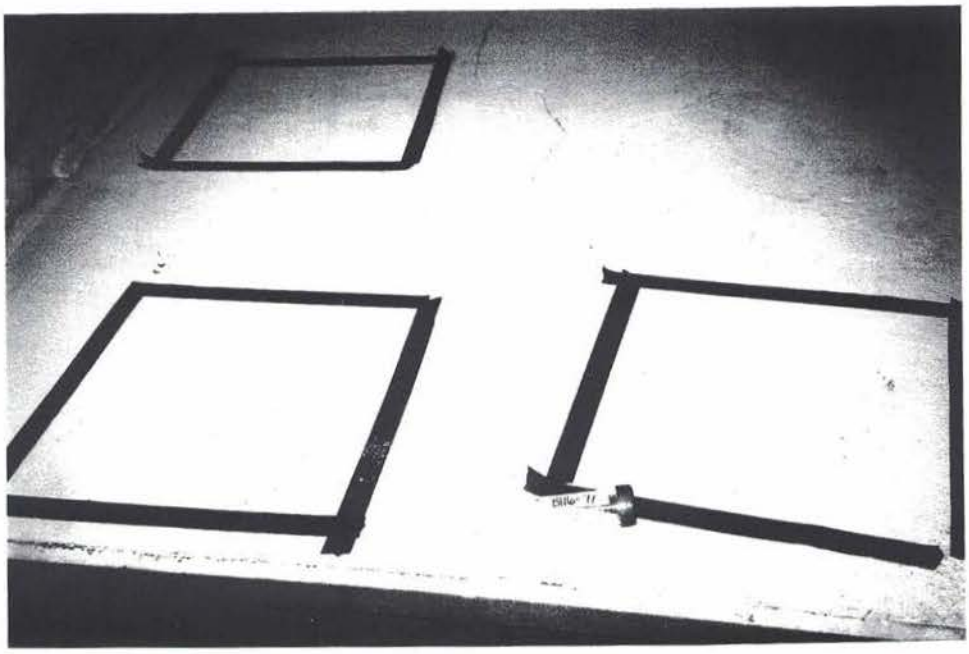


Photo #62: Post-abatement lead wipe sample -71, collected on the basement north stairwell landing, is reported with a lead count of 260 ug/ft^2 which exceeds the HUD clearance level of 40 ug/ft^2 for floors. This is the 3rd re-test for leaded dust in the basement north stairwell landing. Viewing down, and to the east.

Photo #63: Mold contamination present inside the northwest room inside the north basement recreation room, has been removed. Note that the opened and biocleaned wall cavities have been cut to a height of 4 feet. Viewing southeast.

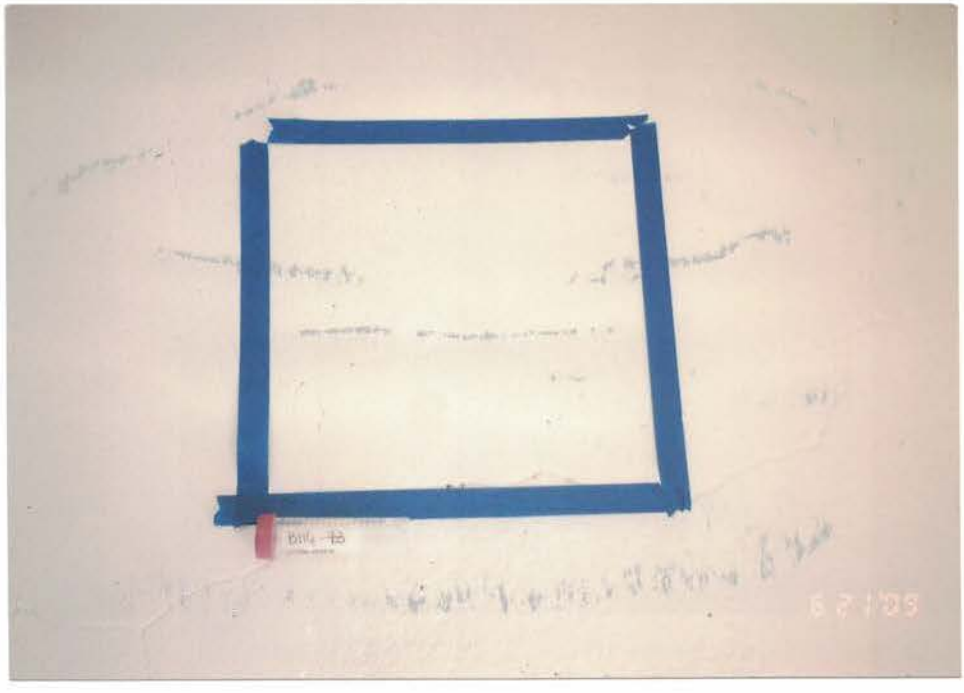


Photo #64: Spray applied a heavy coat of white encapsulant to the north stairwell landing. Lead wipe sample -73, collected on the landing during the 5th re-test, is reported with a total lead content of < 7.5 ug/ft^2. Based on the visual inspection and analytical test results, Tallpines released the north stairwell for reoccupancy. Viewing down.

TALLPINES ENVIRONMENTAL
2 S Beaver St Suite 220, Flagstaff, AZ 86001

(01)

FIELD ACTIVITY DAILY LOG

Project Name: Bldg 1/Boys dormitory
Client: White Mountain Apache Tribe
TEC Personnel on Site: Sharon Layne
Contractor: Stay Systems
Contractor/Supervisor: Julio Aranda

Date: March 2, 2009
Project No.: 09TEC104.ABA
Sheet ____ of ____
# of Workers: ____

3/2/09: Trash being loaded into dumpsters. Clean out of all 3 floors & attic of personal debris complete or almost complete (basement left & carpet). No abatement started. No neg. air machines or containment. Hazard Signage in place at front entry - Chain link fence barrier.

3/9/09: One single stage decon w/ asbestos signage in place at 2nd floor southeast entry. No asbestos abatement has begun. Scraping of chipped/loose paint w/ wet methods & bagged debris. Stairwell(s) paint not abated. Workers in proper PPE. No negative air pressure, machines present but not running. Barriers not in place over windows. No decon at front entry. Water & Cents, personal items at SE entry landing.

(02)

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

PRE-ABATEMENT WORK AREA VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Pre-Renovation Abatement of Hazards	Location:	Fort Apache, B116/Boy's Dormitory
Client Contact:	Franklin Quintero White Mountain Apache Tribe	Date: Time: 11:33 am	March 2, 2009 ~~3/9/09~~
Contractor:	Spray Systems Environmental, Tempe	Work Area:	Exterior soffit/fascia

A) INSPECTION ✓ First Inspection ____ Reinspection

INSPECTION ITEMS:		Pass	Fail
1.	Adequate negative air (-.025 inches/water)	____	✓
2.	Proper containment, critical barriers & z-flaps	____	✓
3.	3-stage decontamination unit	____	✓
4.	Adjustable cold/hot water shower & water filtration unit	____	✓
5.	Waste load-out area	✓	____
6.	Electrical supply and GFCIs	✓	____
7.	HVAC system shutdown, and isolated (includes ductwork)	✓	____
8.	Properly located DANGER ASBESTOS & LEAD hazard of communication signs	✓	____
9.	Contractor medical, fit-test, AHERA & Lead certificates are current	✓	____
10.	Contractor Health & Safety Meeting sheet has been signed	____	✓

B) AUTHORIZATION TO PROCEED

____ The regulated work areas have been properly prepared, & the asbestos abatement may proceed.

✓ Abatement work will not proceed until the following discrepancies are corrected:

No abatement has begun. Workers loading out debris into dumpsters (furniture, trash, etc..). No neg air or decon units in place yet.

C) MANDATORY SIGNATURES

Abatement AHERA Contractor/Supervisor Julio Angulo (Print Name) _____ (Signature) 03-02-09 (Date)

Tallpines' AHERA Contractor/Supervisor Sharon Lynne (Print Name) _____ (Signature) 3/2/09 (Date)

TALLPINES' DAILY FIELD SAFETY MEETING

Project B116/Boy's Dormitory Job No. 09TEC104.ABA

Site Address Historic Fort Apache Client White Mountain Apache Tribe

Date March 9, 2009 Time 2:58 pm

Health & Safety Officer (HSO) Sharon Lynne, Industrial Hygienist

Type of Work: LEAD-BASED PAINT COMPONENT & ASBESTOS ABATEMENT OVERSIGHT SERVICES

ON-SITE POTENTIAL PHYSICAL/CHEMICAL HAZARDS			
	POTENTIAL HAZARDS		PREVENTION MEASURES
1)	The inhalation of airborne asbestos fibers and lead-contaminated dust during removal activities.	1)	Remove under wetted conditions using HEPA vacuums.
2)	Electrical hazards	2)	Lockout/tagout and avoid electrical wires during removal activities.
3)	Injury from loading lead-based paint (LBP) and asbestos wastes.	3)	Workers are to work in teams, and are to keep the size of waste bags to a reasonable weight. Take precautions to minimize waste from tearing/puncturing the wrap.
4)	Encounter with skunks, cats, dogs, insects and/or rodents during removal activities. Potential hazards include being sprayed, bites which may transmit rabies, the airborne Hanta virus transmitted from rodent droppings, and the bubonic plaque bacteria transmitted by fleas.	4)	Avoid all physical contact. If an animal appears to be ready to attack or a rabid animal is observed, vacate the area immediately. If rodent droppings are observed, do not disturb. If a dead animal is observed, cease removal activities and vacate area immediately. Report suspicious animal behavior to the Health & SO.
5)	Heat exhaustion	5)	Take frequent breaks and drink lots of water.
6)	Airborne lead-contaminated dust.	6)	Use HEPA vacuum to keep dust and debris from escaping the work area. If wind gusts exceed 10 mph occur, quickly HEPA vacuum work area and stop all work until wind gusts have ceased. Workers are not to continue with work under gusty conditions.
PERSONAL PROTECTION EQUIPMENT (PPE), MODIFIED LEVEL C			
1)	Half- or full-face, negative air pressure respirator with NIOSH-approved HEPA cartridges, & disposable Tyvek suits. Maximum use level (MUL) for half-face not to exceed 1.0 f/cc in work area. MUL for full-face not to exceed 5.0 f/cc in work area.	1)	To be worn when worker is performing removal activities. Remove respirator and Tyvek suit during lunch break. At a minimum, wash hands & face before eating or drinking.
2)	Sturdy work boots/shoes with skid-proof tread	2)	To be worn by worker to minimize the risk of falls and slips.

TALLPINES' DAILY FIELD SAFETY MEETING, page 2

ADDITIONAL WORKER PRECAUTIONS

1) If the worker identifies friable suspect-ACBMs or materials which will be rendered friable during the removal activities, inform the AHERA Contractor/Supervisor. The work area will be flagged with banner tape labeled *"DANGER ASBESTOS Cancer and Lung Disease Hazard", or "DANGER LEAD HAZARD, Authorized Personnel Only, Respirators and Protective Clothing Are Required in This Area"*.

2) Following removal activities, all disposable Tyveks, gloves, decontamination wipe cloths, used HEPA filters, etc., will be disposed of as waste and labeled with *"DANGER, Contains Asbestos Fibers, Avoid Creating Dust, Cancer and Lung Disease Hazard, Avoid Breathing Airborne Asbestos Fibers", or "DANGER, Lead Containing Hazardous Waste, Avoid Creating Dust"*.

3) The removal activities are to be conducted within a regulated work area. Individuals that did not attend this health & safety meeting, and did not sign this health & safety sheet are to be considered **UNAUTHORIZED and denied access** to the regulated work area. Immediately inform the AHERA Contractor/Supervisor of the presence of unauthorized individuals at the site.

4) Tallpines has held this health & safety meeting for the purpose of worker awareness and worker protection. Tallpines is not responsible for the health of safety of any worker, building occupant, or visitor to the site. Safety meeting attendee signature below indicates understanding and acknowledgement of these declarations.

EMERGENCY PROCEDURES

1) In the event of an accident, the injured worker will be transported to the Navapache Hospital located at 2200 E. Show Low Lake Road in Show Low, Arizona (928) 537-4375.

2) If the injury is severe, **call 911** for emergency personnel response

SAFETY MEETING ATTENDEES

Name (Printed) and Date	*Signature*
Sharon Lynne, Health & Safety Officer 3/9/09	
HEATH HAMILTON 3/9/09	Heath Hamilton
Misael Delgado	Misael Delgado
Luis Naranjo	
Julio Anguilo	
Guillermo Vallejo	
Jesus Fontes	
Ryan Bayerle	
Tomas Zazueta	
Hugo Gonzalez	Hugo Gonzalez

Gentlemen, attached are the TEM analytical test results for airborne asbestos structures measured inside the B116 boiler room following removal of asbestos-containing piping and boiler insulation. Based on the visual inspection and analytical test results, the boiler room is safe for reoccupancy, and can be entered without respiratory protection. This is the ONLY portion of the B116 that has been cleared for re-entry. Thanks, Patty

-------- Original Message --------
Subject:FQ 0902495 /B116 Boiler Room/Fort Apache
Date: Tue, 14 Apr 2009 06:11:51 -0700
From: Karen Grant / KLK <ke2grant@fiberquant.com>
Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	tem
Date Rec'd:	04/13/09
Qty Rec'd:	7
TAT Req'd:	24hr

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT WORK AREA VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Abatement Air Monitoring	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time: 12:00	April 9, 2009
Contractor:	Spray Systems	Work Area:	B116 basement boiler room

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Work Area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, sheet plastic, etc.), and has found no visible dust and/or debris.

Abatement AHERA Contractor/Supervisor: Rick Liddle (Contractor Supervisor) 4/9/09
(Print Name) (Signature) (Date)

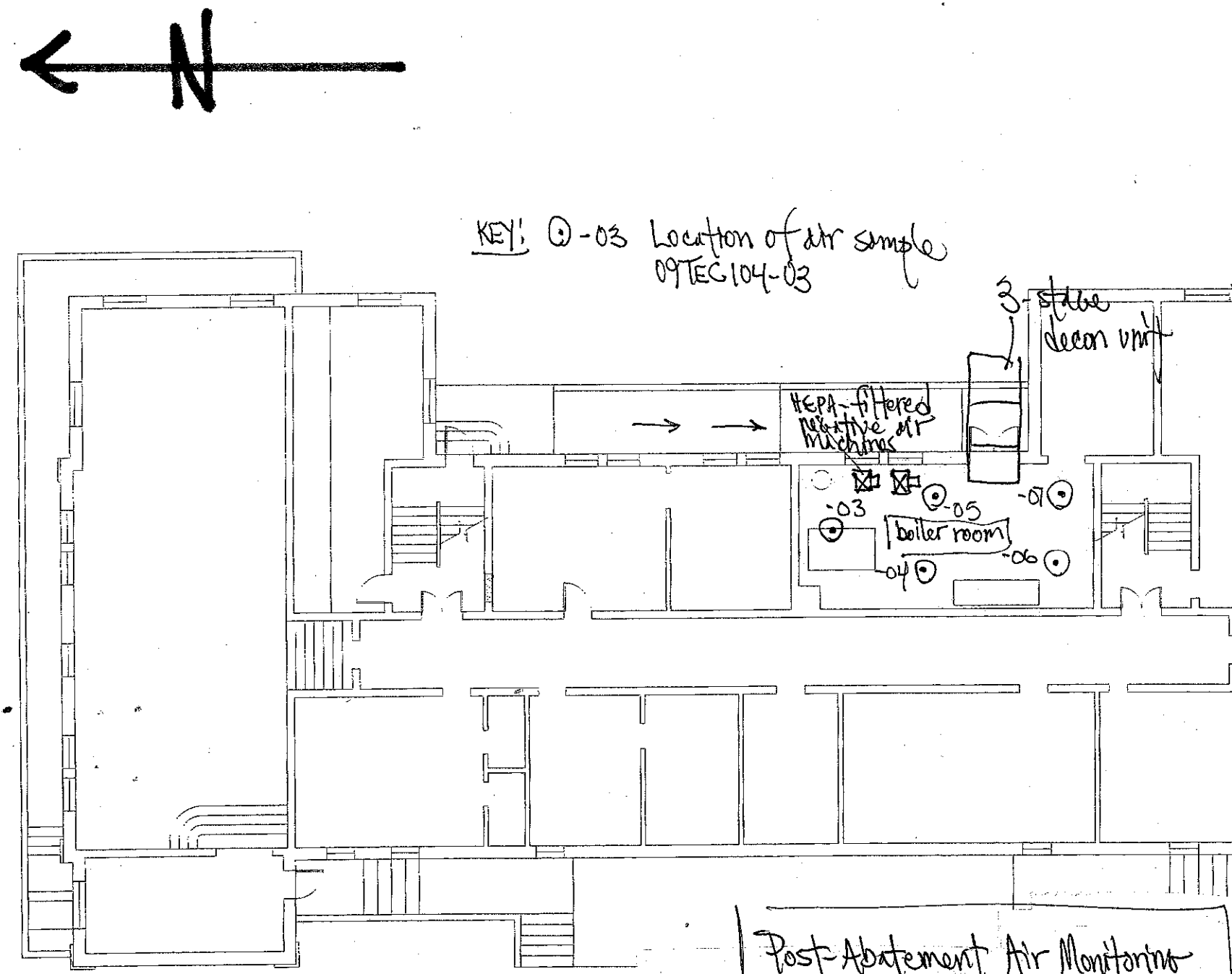
C) TALLPINES' AHERA CONTRACTOR/SUPERVISOR'S CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible debris on walls or floors
2. ✓ No visible debris between ceiling & beams
3. ✓ No visible debris behind perimeter columns
4. ✓ No visible debris on top of ductwork
5. ✓ No visible debris on hangers, rods, or lights
6. ✓ No visible debris on surfaces covered by poly
7. ✓ No visible debris on pipes
8. ✓ All bags of waste removed from work area
9. ✓ All equipment clean, including underside of negative air units
10. Negative pressure is stabilized at -0.03 inches/water
11. Airless spray equipment used for encapsulation
12. ✓ The regulated work area is suitable for encapsulation

D) AUTHORIZATION TO PROCEED WITH RELEASE/ENCAPSULATION OF WORK AREA: ✓ YES ____ NO

Comments: No remaining TSI on pipes. Boiler removed. No debris on floor or walls or tops of pipes. All insulation removed - Area is thoroughly clean. 3 stage wet decontamination Unit at entry to boiler room. Great job!

Tallpines' AHERA Contractor/Supervisor: Sharon Lynne 4/9/09
(Print Name) (Signature) (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement Air Monitoring
B116/Boys Dormitory
Basement/boiler room
Tallpines Job No. 09TEC104.CLR

TALLPINES' AIR SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: TSI Abatement
Job No.: 09TEC104.CLR
Location: B104/Fort Apache
Date: ~~April~~ 9th, 2009 Thursday

Sample Number	Sample Type	Pump No.	Pump Location	Worker Activity	Time On	Time Off	Total Time (Min)	Initial Flow Rate (Lpm)	Final Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L)
09TEC104-01	FB	—	Field blank	NA	12:12	12:12	Ø	—	—	—	Ø
09TEC104-02	FB	—	Field blank	NA	12:12	12:12	Ø	—	—	—	Ø
09TEC104-03	CL/WA	H-04A	Basement boiler room; North	NA	12:23	2:23	120	10.09	10.01	10.05	1,206.0
09TEC104-04	CL/WA	H-12	Basement boiler room; NW	NA	12:25	2:25	120	10.81	10.60	10.7	1,284.6
09TEC104-05	CL/WA	H-11	Basement boiler room; NE	NA	12:26	2:26	120	10.64	10.60	10.62	1,274.4
09TEC104-06	CL/WA	H-02	Basement boiler room; SW	NA	12:27	2:27	120	10.02	10.0	10.01	1,201.2
09TEC104-07	CL/WA	H-08	Basement boiler room; SE	NA	12:28	2:28	120	10.20	10.09	10.14	1,217.4

Sampled by: Sharon Lynne
Signature:

ACTIVITY: PREP = work area preparation, CU = cleanup, REM = removal, GB = glovebag, L/O = load out, CL = clearance, NA = no activity

SAMPLE TYPE: A = area, BL = baseline, BR = barrier, CL = clearance, NAE = neg air exhaust, FB = field blank, B = Blank, P = perimeter, WA = work area

* Flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

ASBESTOS CHAIN-OF-CUSTODY

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104.CLR
PROJECT NAME: B116 Boiler Room / Fort Apache
CLIENT/COMPANY: White Mountain Apache Tribe, C/o Tallpines
SAMPLER (SIGNATURE):
SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	FRIABLE (Y/N)	SAMPLE METHOD: BULK	WIPE	PERSONAL AIR	INSIDE/OUTSIDE	AREA AIR	FINAL CLEARANCE	ANALYSIS METHOD: PLM	PCM	TEM	TOTAL VOLUME (LITERS)	HOMOGENEOUS AREA DESCRIPTION
09TEC104-01	4/9/09	12:12	outside					O		X			X	0	field blank
09TEC104-02		12:12	outside					O		X			X	0	
09TEC104-03		2:23	Basement boiler room N.					I		X			X	1,206.0	clearances
09TEC104-04		2:25	Basement boiler room NW					I		X			X	1,284.6	
09TEC104-05		2:26	Basement boiler room NE					I		X			X	1,274.4	
09TEC104-06		2:27	Basement boiler room SW					I		X			X	1,201.2	
09TEC104-07		2:28	Basement boiler room SE					I		X			X	1,217.4	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME
	4/9/09	6:30pm				

PCM TAT: ☐ 1-4 HOURS ☒ 24 HOURS

SHIPPER INFORMATION	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
FedEx: 8684-7067-5629				4/13/09	10:04

SAMPLE PROCESS TURNAROUND TIME: ☐ 1-6 HOURS ☐ 1-3 DAYS ☐ 10-15 DAYS

FIBERQUANT ANALYTICAL SERVICES

Determination of Asbestos Structures in Air

JobNumber: 200902495

Client: TALLPINES ENV CONSLTNG CO
10 W DALE AVE

FLAGSTAFF, AZ 86001-0000
Office Phone: (928) 774-0060
FAX: (928) 774-0051

 # Samples: 7 TEM **Rec:** 4/13/2009 **Method:** AHERA TEM TEM analysis of air sample
Client Job: B116 Boiler Room / Fort Apache **PO Number:** 09TEC104.CLR
Report Date: 4/13/2009 **Date Analyzed:** 4/13/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** TEMa

The samples were prepared and analyzed using AHERA (Appendix A to Subpart E - Interim Transmission Electron Microscopy Analytical Methods, US EPA 40 CFR Pt. 763, Mandatory Method) protocols. Each cassette is first wiped with a damp cloth to prevent contamination of the filter insides. Then, a wedge of filter is excised using a cleaned scalpel. The wedge is placed on a new glass slide, and cleared using hot acetone vapor from a "hot block" apparatus. The cleared filter is then ashed in a plasma etcher to remove 1-2 um of filter from its surface, then coated with 100-200 um of carbon in a carbon evaporator. The carbon encapsulates all of the larger and most of the smaller particulate on the filter. Three mm square pieces of the coated filter are placed on copper TEM grids, and the original filter material is dissolved away in a Jaffe wick and/or condensation washer. The finished replica in carbon containing the particulate is then examined on a transmission electron microscope at 10,000 to 20,000x magnification. All asbestos fiber structures >0.5um in length are characterized as asbestos or non-asbestos using a combination of morphology, electron diffraction characteristics, and elemental composition. A "structure" has certain narrow characteristics as defined in AHERA, and may be a single fiber, a bundle of parallel fibrils, a "matrix" structure (a fiber(s) extending out of a non-fibrous particle), or a cluster of matted or inter-connected fibers. Results are calculated both in structures/mm2 of filter surface and as structures/cc of air. The grid is scanned until an analytical sensitivity (the hypothetical observation of one structure) of at least 0.005 str/cc is reached.

For clearance monitoring, AHERA (Asbestos Hazard Emergency Response Act) states that an area in a school may be re-occupied when the average of 5 inside air samples having a minimum volume of 1200 liters is <70 str/mm2 when measured by this method; or when 5 interior air samples have been shown to be statistically indistinguishable from 5 exterior air samples using the z-test.

The coefficient of variation for this method is estimated to be approximately 0.5 for analyses in which >20 asbestos fibers have been counted, ranging up to 1.00 for analyses in which only a few asbestos fibers are counted.

The analysis was performed under an ongoing quality assurance program which includes: Client supplied blanks are prepared with each set of samples, and analyzed when sample asbestos levels are found to average >70 f/mm2, or at a level of one blank analysis per every 25 sample analyses. Lab blanks are also prepared with each set of samples, and analyzed in place of client blanks when none are submitted. Each analyst has suitable background credentials, such as at least a bachelor's degree in geology or chemistry, and has undergone extensive 2-6 month training in TEM techniques and mineralogy specific to TEM asbestos analysis before being allowed to perform client analyses. Unknown reference samples are routinely identified to ensure that each analyst can collect and correctly interpret TEM information. The TEM is aligned and its performance checked daily. Magnification, electron diffraction pattern size, and analytical performance characteristics are calibrated routinely. Samples are re-analyzed sometimes by the same analyst and sometimes by a different analyst in order to determine accuracy and precision. The total of QC analyses (blanks + recounts) are greater than 10% of analyzed samples. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Each analyst participates in interlab round robins and proficiency testing in order to show correlation to other lab's analyses. Fiberquant is accredited by NVLAP (Lab #101031) to perform TEM analysis of asbestos in air samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Analysis Results:

Job Number:	200902495	B116 Boiler Room / Fort Apache

Blanks

Lab Number	Client Number	Date	Vol (L)	Location	Condition	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
2009-02495-1	09TEC104-01	4/9/2009	0	Blank	acceptable	0	0.00969	Not Analyzed		
2009-02495-2	09TEC104-02	4/9/2009	0	Blank	acceptable	0	0.00969	Not Analyzed		

Inside Samples

Lab Number	Client Number	Date	Vol (L)	Location	Condition	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
2009-02495-3	09TEC104-03	4/9/2009	1206	Inside	acceptable	6	0.00969	-	*17*	*0.005*
Chrysotile All: 1 str, 17 str/mm2, 0.005 str/cc. Chrysotile >5um: 1 str, 17 str/mm2, 0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc.									Non-Asbestos:	0 cnts
Analytical Sensitivity: .005										
2009-02495-4	09TEC104-04	4/9/2009	1284.6	Inside	acceptable	6	0.00969	-	*<17*	*<0.005*
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc.									Non-Asbestos:	0 cnts
Analytical Sensitivity: .005										
2009-02495-5	09TEC104-05	4/9/2009	1274.4	Inside	acceptable	6	0.00969	-	*<17*	*<0.005*
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc.									Non-Asbestos:	0 cnts
Analytical Sensitivity: .005										
2009-02495-6	09TEC104-06	4/9/2009	1201.2	Inside	acceptable	7	0.00969	-	*<15*	*<0.005*
Chrysotile All: 0 str, <15 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <15 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <15 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <15 str/mm2, <0.005 str/cc.									Non-Asbestos:	0 cnts
Analytical Sensitivity: .005										
2009-02495-7	09TEC104-07	4/9/2009	1217.4	Inside	acceptable	6	0.00969	-	*17*	*0.005*
Chrysotile All: 1 str, 17 str/mm2, 0.005 str/cc. Chrysotile >5um: 1 str, 17 str/mm2, 0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc.									Non-Asbestos:	0 cnts
Analytical Sensitivity: .005										

Average Str/mm2	*6.9*

Uwe Steimle

Analyst: UWE .. STEIMLE

Printed: 13-Apr-09

Original Print Date: 13-Apr-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: ✓ AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

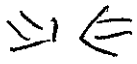
Client Smp #: **09TEC104-03**

Lab #: **2009-02495- 3** Vol (L): 1206

✓ MCE ___ PC Pore um: ___ 0.8 ✓ 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: ✓ Jeol N ___ Jeol S Mag: 20K or 15K Alignment: ✓ checked EDS: ___ calib ✓ not used

Ac. Volatage: ___ 100keV ✓ 120keV ___ keV

Fiber Counts:

Est. % Loading 5

Grid Storage # 1023 N1 Acceptable Prep ✓ (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
F10	N1																									
H9	4																									
J8	1			✓		5.3	0.1	✓					✓				281								CH	

Grid Storage # 1023 N3 Acceptable Prep ✓ (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

G12	N3																									
I13																										
K14																										

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 1	CH > 5 1	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 17	Str/cc 0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-13-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

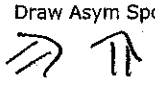
Client Smp #: **09TEC104-04**

Lab #: **2009-02495- 4** Vol (L): 1284.6

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 3

Grid Storage # 1023 N7 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
J13	NSD																									
K11	↓																									
L9	↓																									

Grid Storage # 1023 N9 Acceptable Prep ___ (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

I8	NSD																									
H10	↓																									
G12	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All	0	CH > 5		AP All	0	AP > 5		NA All		# GOs 6
Results:	Str/mm2	<17	Str/cc	<0.005	If > 70 Str/mm2, Blank OK? ☐			(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** 4-13-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

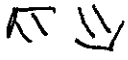
Client Smp #: **09TEC104-05**

Lab #: **2009-02495- 5** Vol (L): 1274.4

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ____ keV

Fiber Counts:

Est. % Loading 4

Grid Storage # 1023 04 Acceptable Prep X (>50% coverage, >50% Intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
I7	NSD																									
H9	↓																									
G11	↓																									

Grid Storage # 1023 06 Acceptable Prep X (>50% coverage, >50% Intact, no folds, <5% opaque, 20 good GOs

L8	NSD																									
K10	↓																									
J12	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)		

Notes:

Analyst: Uwe Steinle **Date:** 4-13-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Prep Map

Grid Orientation
Draw Asym Spot

E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Sample Information

Client: TALLPINES ENV CONSLTNG CO

Client Smp #: **09TEC104-06**

Lab #: **2009-02495- 6** Vol (L): 1201.2

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 7

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 5

Grid Storage # 1023 010 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
J15	NSD																									
K13	↓																									
L11																										
M9	↓																									

Grid Storage # 1023 P1 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

H2	NSD																									
G10	↓																									
F8																										

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 7	
Results:	Str/mm2 <15	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** 4-13-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

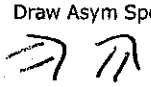
Client Smp #: **09TEC104-07**

Lab #: **2009-02495- 7** Vol (L): 1217.4

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	X	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	X			I12	I13	I14	I15
J6	J7	O	J9			J12	J13	J14	J15
K6	K7	X	K9	O	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	O	L13	L14	L15
M6	X	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 3

Grid Storage # 1023 P5 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
M7	1																									
K8	1																									
I9	1																									
G10	1																									

Grid Storage # 1023 P7 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

J8	1		√			9.5	0.2	√	√				√												ch	
K10	1																									
	11																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All	1	CH > 5	1	AP All	0	AP > 5		NA All		# GOs	6
Results:	Str/mm2	15	Str/CC	0.005	If > 70 Str/mm2, Blank OK? Q		(If Blank is contaminated, put action under notes)					

Notes:

Analyst: Uwe Steinle **Date:** 4-13-09

Subject: Scheduled Testing for B116
From: tallpines@bmol.com
Date: Sun, 12 Apr 2009 11:49:24 -0700
To: Dave Kennedy <dkennedy@spraysystemseri.com>, fquinterosr@yahoo.com, Mickey Estrada <mickeyestrada@yahoo.com>

Dave, as per Rick Liddle's estimate, we are scheduled to test B116 Wednesday/Thursday, April 15th and 16th. Two inspectors will arrive Wednesday afternoon to conduct testing for asbestos, leaded dust, and mice allergens in the basement. On Thursday, they will test the 2nd and 3rd floors as well as the attic. Please make sure the concrete floors have been sealed with some type of encapsulant or there could be leaded dust failures. Thanks, Patty at Tallpines

Gentlemen, attached are the TEM analytical test results (15 samples, 3 floors) for airborne asbestos structures measured inside B116 following the abatement of asbestos-containing vinyl floor tile/black mastic. All 15 samples are reported at <17 structures per square millimeter (str/mm2), or below the laboratory detection limit for asbestos. The basement boiler room was tested last week. Airborne asbestos is no longer an issue in B116, but we need to await the leaded dust sample results before releasing the building for reconstruction. Patty

-------- Original Message --------
Subject:FQ 0902694 /WMAT/B116/Fort Apache
Date: Tue, 21 Apr 2009 14:19:38 -0700
From: Karen Grant / JAL <ke2grant@fiberquant.com>
Reply-To: Karen Grant <ke2grant@fiberquant.com>
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Karen G ☐ Kathy K ☐ Kathy T ☐

Method / Type:	tem
Date Received:	04/20/09
Qty Received:	17
TAT Requested:	24hr

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT WORK AREA VISUAL INSPECTION			
Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Abatement Air Monitoring	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	April 16, 2009 11:08 am
Contractor:	Spray Systems	Work Area:	B116 2nd floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Work Area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, sheet plastic, etc.), and has found no visible dust and/or debris.

Abatement AHERA Contractor/Supervisor: Rick Liddle (Print Name) [signature] (Signature) 4/16/09 (Date)

C) TALLPINES' AHERA CONTRACTOR/SUPERVISOR'S CERTIFICATION OF VISUAL INSPECTION

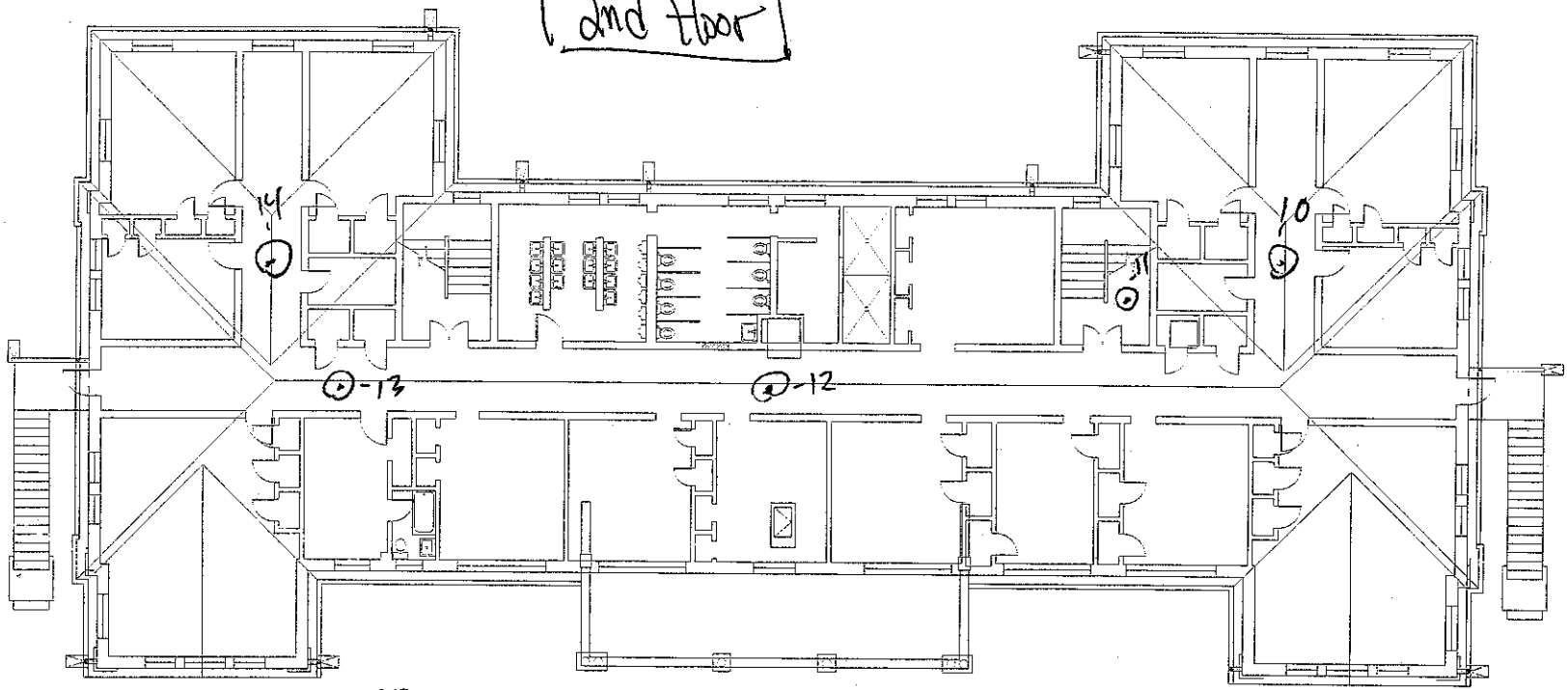
1. ✓ No visible debris on walls or floors
2. ✓ No visible debris between ceiling & beams
3. ✓ No visible debris behind perimeter columns
4. ✓ No visible debris on top of ductwork
5. ✓ No visible debris on hangers, rods, or lights
6. ✓ No visible debris on surfaces covered by poly
7. ✓ No visible debris on pipes
8. ✓ All bags of waste removed from work area
9. ✓ All equipment clean, including underside of negative air units
10. ✓ Negative pressure is stabilized at -0.03 inches/water
11. ✓ Airless spray equipment used for encapsulation
12. ✓ The regulated work area is suitable for encapsulation

D) AUTHORIZATION TO PROCEED WITH RELEASE/ENCAPSULATION OF WORK AREA: ✓ YES ____ NO

Comments: Vinyl floor tile and mastic thoroughly removed. No remaining mastic on concrete floors. Very nice job. Thorough and clean.

Tallpines' AHERA Contractor/Supervisor: Sharon Lynne (Print Name) [signature] (Signature) 4/16/09 (Date)

2nd Floor



2nd Floor

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

N

Post-Abatement TEM Air Monitoring
B116/Boy's Dormitory - 2nd Floor
Tallpines Job No. 09TEC104.CLR

02

2nd floor

TALLPINES' AIR SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: TSI Abatement
Job No.: 09TEC104.CLR
Location: B104/Fort Apache
Date: April 15, 2009 Wednesday

Sample Number	Sample Type	Pump No.	Pump Location	Worker Activity	Time On	Time Off	Total Time (Min)	Initial Flow Rate (Lpm)	Final Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L)
09TEC104-08	FB	—	Field blank	NA	—						Ø
09TEC104-09	FB	—	Field blank	NA	—						Ø
09TEC104-10	CL	H-04	2nd floor; SE hall	NA	10:39	12:39	120	10.42	10.12	10.27	1232.4
09TEC104-11	CL	H-02A	2nd floor; S. Stairwell	NA	10:42	12:42	120	10.31	10.10	10.20	1224.6
09TEC104-12	CL	H-08	2nd floor; Central hall	NA	10:43	12:46	123	10.43	10.30	10.36	1274.8
09TEC104-13	CL	H-04	2nd floor; N. Hall	NA	10:45	12:48	123	10.39	10.25	10.32	1269.3
09TEC104-14	CL	H-12	2nd floor; NE Hall	NA	10:46	12:53	127	10.42	10.14	10.28	1305.5

Sampled by: Michael Bell

Signature: Michael Bell

ACTIVITY: PREP = work area preparation, CU = cleanup, REM = removal, GB = glovebag, L/O = load out, CL = clearance, NA = no activity

SAMPLE TYPE: A = area, BL = baseline, BR = barrier, CL = clearance, NAE = neg air exhaust, FB = field blank, B = Blank, P = perimeter, WA = work area

* Flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

03

POST-ABATEMENT WORK AREA VISUAL INSPECTION			
Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Abatement Air Monitoring	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	April 16, 2009 11:08 am
Contractor:	Spray Systems	Work Area:	B116 basement and 1st floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Work Area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, sheet plastic, etc.), and has found no visible dust and/or debris.

Abatement AHERA Contractor/Supervisor: Rick Liddle (Print Name) _____ (Signature) 4/16/09 (Date)

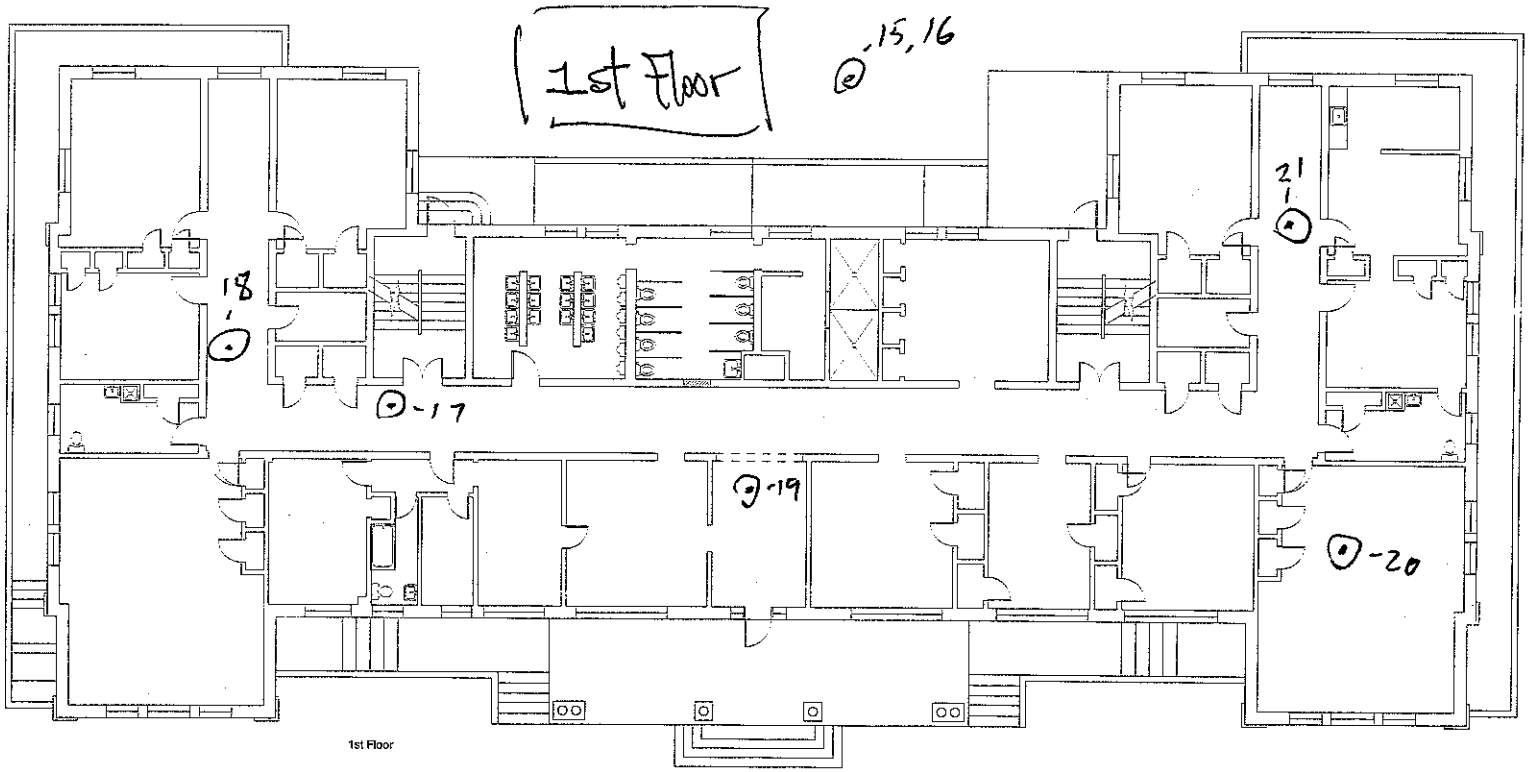
C) TALLPINES' AHERA CONTRACTOR/SUPERVISOR'S CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible debris on walls or floors
2. ✓ No visible debris between ceiling & beams
3. ✓ No visible debris behind perimeter columns
4. ✓ No visible debris on top of ductwork
5. ✓ No visible debris on hangers, rods, or lights
6. ✓ No visible debris on surfaces covered by poly
7. ✓ No visible debris on pipes
8. ✓ All bags of waste removed from work area
9. ✓ All equipment clean, including underside of negative air units
10. ✓ Negative pressure is stabilized at -0.03 inches/water
11. ✓ Airless spray equipment used for encapsulation
12. ✓ The regulated work area is suitable for encapsulation

D) AUTHORIZATION TO PROCEED WITH RELEASE/ENCAPSULATION OF WORK AREA: ✓ YES ___ NO

Comments: Vinyl floor tile and mastic has been thoroughly removed from concrete floors. Nice job. Areas clean no dust on surfaces.

Tallpines' AHERA Contractor/Supervisor: Sharon Lynne (Print Name) _____ (Signature) 4/16/09 (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement TEM Air Monitoring
B116/Boys Dormitory - 1st Floor
Tallgrass Job No: 09TEC104.CLR

03

1st floor

TALLPINES' AIR SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Vinyl floor tile/mastic
Job No.: 09TEC104.CLR
Location: B104/Fort Apache
Date: April 16, 2009 Thursday

Sample Number	Sample Type	Pump No.	Pump Location	Worker Activity	Time On	Time Off	Total Time (Min)	Initial Flow Rate (Lpm)	Final Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L)
09TEC104-15	FB	—	Field blank ; outside containment East of entrance	NA	8:00	8:00	0.5	—		—	Ø
09TEC104-16	FB	—	Field blank ↓	NA	8:00	8:00	0.5	—		—	Ø
09TEC104-17	CL	H-09	1st floor; N Central Hall	NA	8:33	10.48 ~~10.48~~	135	10.47	9.76	10.11	1264.3
09TEC104-18	CL	H-07	1st floor; N Hallway	NA	8:35	10.49	124	10.41	10.47	10.44	1294.5
09TEC104-19	CL	H-11	1st floor; Central	NA	~~8:38~~	10.51	133	10.27	10.46	10.36	1378.5
09TEC104-20	CL	H-01	1st floor; SW Room	NA	8:46	10.53	127	10.48	10.59	10.53	1337.9
09TEC104-21	CL	H-02	1st floor; SE Room	NA	8:48	10.55	127	10.27	10.08	10.17	1292.2

Sampled by: Michael Bell
Signature: Michael Bell

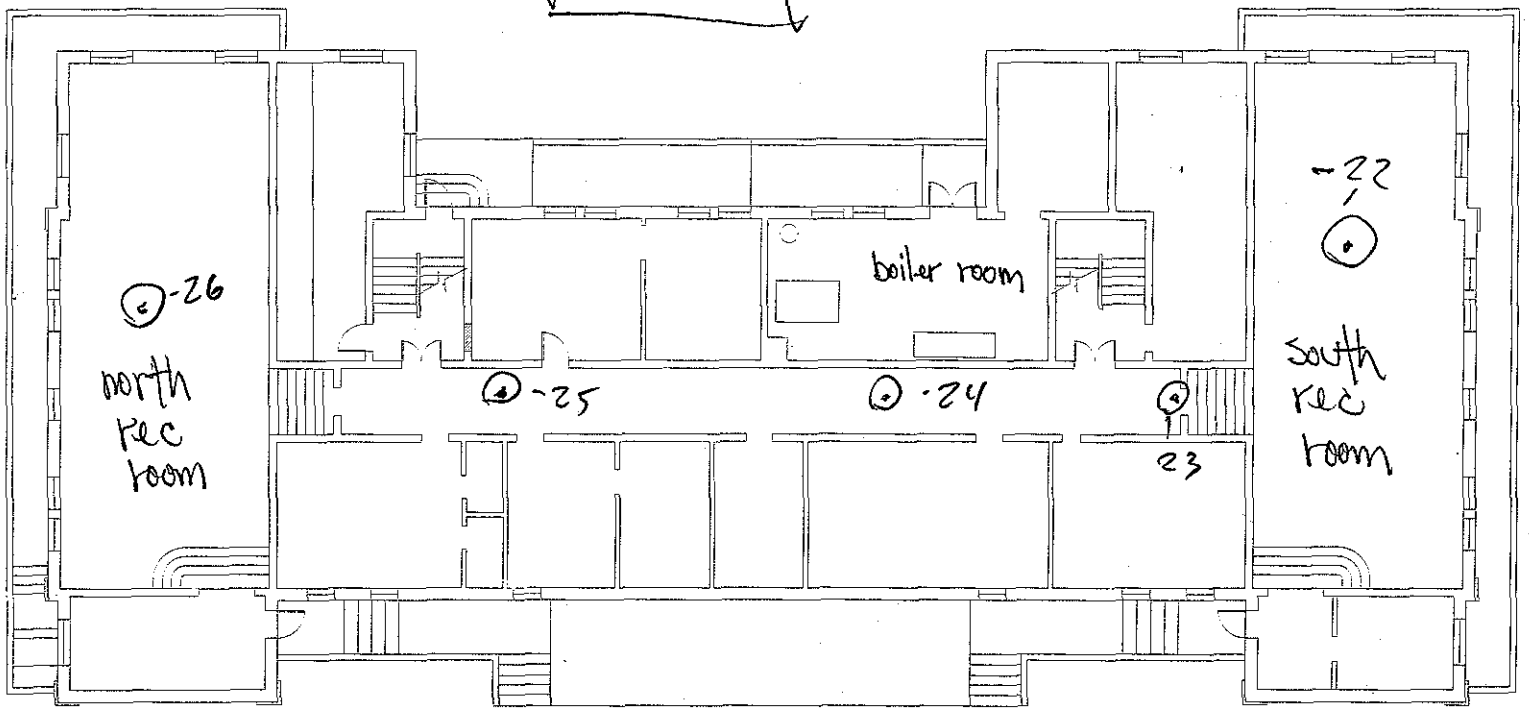
ACTIVITY: PREP = work area preparation, CU = cleanup, REM = removal, GB = glovebag, L/O = load out, CL = clearance, NA = no activity

SAMPLE TYPE: A = area, BL = baseline, BR = barrier, CL = clearance, NAE = neg air exhaust, FB = field blank, B = Blank, P = perimeter, WA = work area

* Flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

N

Basement



Basement

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement TEM Air Monitoring
B116 / Boys Dormitory - BASEMENT
Tetra Tech Job No. 09TEC104.CLR

Basement

(03)

TALLPINES' AIR SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Vinyl floor tile/mastic
Job No.: 09TEC104.CLR
Location: B104/Fort Apache
Date: April 16, 2009 Thursday

Sample Number	Sample Type	Pump No.	Pump Location	Worker Activity	Time On	Time Off	Total Time (Min)	Initial Flow Rate (Lpm)	Final Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L)
09TEC104-											
09TEC104-											
09TEC104-22	CL	H-02A	Basement; South Room	NA	8:18	10:23	125	10.50	10.63	10.56	1320.6
09TEC104-23	CL	H-04	Basement; S Hallway	NA	8:20	10:25	125	10.48	10.60	10.5	1317.5
09TEC104-24	CL	H-09	Basement; Central Hallway	NA	8:23	10:28	125	10.45	10.55	10.50	1312.5
09TEC104-25	CL	H-12	Basement; N Hallway	NA	8:25	10:29	124	10.34	10.45	10.39	1288.9
09TEC104-26	CL	H-04	Basement; N Room	NA	8:27	10:31	124	10.42	10.59	10.50	1302.6

Sampled by: Michael Bell
Signature: Michael Bell

ACTIVITY: PREP = work area preparation, CU = cleanup, REM = removal, GB = glovebag, L/O = load out, CL = clearance, NA = no activity

SAMPLE TYPE: A = area, BL = baseline, BR = barrier, CL = clearance, NAE = neg air exhaust, FB = field blank, B = Blank, P = perimeter, WA = work area

* Flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

ok after pump down

H-09, H-11, H-07

(024)

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

ASBESTOS CHAIN-OF-CUSTODY

B116 / Fort Apache

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104.CLR
PROJECT NAME: B116 / Fort Apache
CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines Environmental
SAMPLER (SIGNATURE): Michael Bell
SAMPLER (PLEASE PRINT): Michael Bell

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	FRIABLE (Y/N)	SAMPLE METHOD: BULK	WIPE	PERSONAL AIR	INSIDE/OUTSIDE	AREA AIR	FINAL CLEARANCE	ANALYSIS METHOD: PLM	PCM	TEM	TOTAL VOLUME (LITERS)	HOMOGENEOUS AREA DESCRIPTION
09TEC104-15	4/16/09	8:00	Field blank					O		X			X	0	Field blank
09TEC104-16		8:00	Field Blank					O		X			X	0	
09TEC104-10		12:39	2nd floor SE hall					I		X			X	1,232.4	Clearances
09TEC104-11		12:42	2nd floor S. Stairwell					I		X			X	1224.6	
09TEC104-12		12:46	2nd floor Central hall					I		X			X	1274.8	
09TEC104-13		12:48	2nd floor N. hall					I		X			X	1269.3	
09TEC104-14		12:53	2nd floor NE hall					I		X			X	1305.5	
09TEC104-17		10:48	1st floor; N. Central hall					I		X			X	1264.3	
09TEC104-18		10:49	1st floor; N. hallway					I		X			X	1294.5	
09TEC104-19		10:51	1st floor; Central					I		X			X	1378.5	
09TEC104-20		10:53	1st floor; SW room					I		X			X	1337.9	
09TEC104-21		10:55	1st floor; SE room					I		X			X	1292.2	
09TEC104-22		10:23	Basement; S. room					I		X			X	1320.6	
09TEC104-23		10:25	Basement; S. hallway					I		X			X	1317.5	
09TEC104-24		10:28	Basement; Central hall					I		X			X	1312.5	
09TEC104-25		10:29	Basement; N. hallway					I		X			X	1288.9	
09TEC104-26	↓	10:31	Basement; N. room					I		X			X	1302.6	

PLM → All samples should be 09TEC116-

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME
Michael Bell	4/16/09	5:30	[illegible]	[illegible]	4/17/09	12:05 pm
SHIPPER INFORMATION	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME	
FedEx 8684-7067-5618			Kathy Knowles	4/20/9	11:23	

TEM TAT

SAMPLE PROCESS TURNAROUND TIME
☐ 1-4 HOURS ☒ 24 HOURS ☐ 1-6 HOURS ☐ 1-3 DAYS ☐ 10-15 DAYS

FIBERQUANT ANALYTICAL SERVICES

Determination of Asbestos Structures in Air

JobNumber: 200902694

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 17 TEM **Rec:** 4/20/2009 **Method:** AHERA TEM TEM analysis of air sample

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104.CLR

Report Date: 4/21/2009 **Date Analyzed:** 4/21/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** TEMa

The samples were prepared and analyzed using AHERA (Appendix A to Subpart E - Interim Transmission Electron Microscopy Analytical Methods, US EPA 40 CFR Pt. 763, Mandatory Method) protocols. Each cassette is first wiped with a damp cloth to prevent contamination of the filter insides. Then, a wedge of filter is excised using a cleaned scalpel. The wedge is placed on a new glass slide, and cleared using hot acetone vapor from a "hot block" apparatus. The cleared filter is then ashed in a plasma etcher to remove 1-2 um of filter from its surface, then coated with 100-200 um of carbon in a carbon evaporator. The carbon encapsulates all of the larger and most of the smaller particulate on the filter. Three mm square pieces of the coated filter are placed on copper TEM grids, and the original filter material is dissolved away in a Jaffe wick and/or condensation washer. The finished replica in carbon containing the particulate is then examined on a transmission electron microscope at 10,000 to 20,000x magnification. All asbestos fiber structures >0.5um in length are characterized as asbestos or non-asbestos using a combination of morphology, electron diffraction characteristics, and elemental composition. A "structure" has certain narrow characteristics as defined in AHERA, and may be a single fiber, a bundle of parallel fibrils, a "matrix" structure (a fiber(s) extending out of a non-fibrous particle), or a cluster of matted or inter-connected fibers. Results are calculated both in structures/mm2 of filter surface and as structures/cc of air. The grid is scanned until an analytical sensitivity (the hypothetical observation of one structure) of at least 0.005 str/cc is reached.

For clearance monitoring, AHERA (Asbestos Hazard Emergency Response Act) states that an area in a school may be re-occupied when the average of 5 inside air samples having a minimum volume of 1200 liters is <70 str/mm2 when measured by this method; or when 5 interior air samples have been shown to be statistically indistinguishable from 5 exterior air samples using the z-test.

The coefficient of variation for this method is estimated to be approximately 0.5 for analyses in which >20 asbestos fibers have been counted, ranging up to 1.00 for analyses in which only a few asbestos fibers are counted.

The analysis was performed under an ongoing quality assurance program which includes: Client supplied blanks are prepared with each set of samples, and analyzed when sample asbestos levels are found to average >70 f/mm2, or at a level of one blank analysis per every 25 sample analyses. Lab blanks are also prepared with each set of samples, and analyzed in place of client blanks when none are submitted. Each analyst has suitable background credentials, such as at least a bachelor's degree in geology or chemistry, and has undergone extensive 2-6 month training in TEM techniques and mineralogy specific to TEM asbestos analysis before being allowed to perform client analyses. Unknown reference samples are routinely identified to ensure that each analyst can collect and correctly interpret TEM information. The TEM is aligned and its performance checked daily. Magnification, electron diffraction pattern size, and analytical performance characteristics are calibrated routinely. Samples are re-analyzed sometimes by the same analyst and sometimes by a different analyst in order to determine accuracy and precision. The total of QC analyses (blanks + recounts) are greater than 10% of analyzed samples. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Each analyst participates in interlab round robins and proficiency testing in order to show correlation to other lab's analyses. Fiberquant is accredited by NVLAP (Lab #101031) to perform TEM analysis of asbestos in air samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Analysis Results:

Job Number:	200902694	WMAT/B116/Fort Apache

Blanks

Lab Number	Client Number	Date	Vol (L)	Location	Condition	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
2009-02694- 16	09TEC104-15	4/16/2009	0	Blank	acceptable	0	0.00969	Not Analyzed		
2009-02694- 17	09TEC104-16	4/16/2009	0	Blank	acceptable	0	0.00969	Not Analyzed		

Inside Samples

Lab Number	Client Number	Date	Vol (L)	Location	Condition	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
2009-02694- 1	09TEC104-10	4/16/2009	1232.4	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 2	09TEC104-11	4/16/2009	1224.6	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 3	09TEC104-12	4/16/2009	1274.8	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 4	09TEC104-13	4/16/2009	1269.3	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 5	09TEC104-14	4/16/2009	1305.5	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 6	09TEC104-17	4/16/2009	1264.3	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 7	09TEC104-18	4/16/2009	1294.5	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 8	09TEC104-19	4/16/2009	1378.5	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 9	09TEC104-20	4/16/2009	1337.9	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										
2009-02694- 10	09TEC104-21	4/16/2009	1292.2	Inside	acceptable	6	0.00969	-	<17	<0.005
Chrysotile All: 0 str, <17 str/mm2, <0.005 str/cc. Chrysotile >5um: 0 str, <17 str/mm2, <0.005 str/cc.										
Amphibole All: 0 str, <17 str/mm2, <0.005 str/cc. Amphibole >5um: 0 str, <17 str/mm2, <0.005 str/cc. Non-Asbestos: 0 cnts										
Analytical Sensitivity: .005										

Analysis Results:

Job Number:	200902694	WMAT/B116/Fort Apache

2009-02694- 11	09TEC104-22	4/16/2009	1320.6	Inside	acceptable	6	0.00969	-		<17	<0.005
Chrysotile All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Chrysotile >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.				
Amphibole All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Amphibole >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.	Non-Asbestos:	0 cnts		
Analytical Sensitivity:	.005										
2009-02694- 12	09TEC104-23	4/16/2009	1317.5	Inside	acceptable	6	0.00969	-		<17	<0.005
Chrysotile All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Chrysotile >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.				
Amphibole All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Amphibole >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.	Non-Asbestos:	0 cnts		
Analytical Sensitivity:	.005										
2009-02694- 13	09TEC104-24	4/16/2009	1312.5	Inside	acceptable	6	0.00969	-		<17	<0.005
Chrysotile All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Chrysotile >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.				
Amphibole All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Amphibole >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.	Non-Asbestos:	0 cnts		
Analytical Sensitivity:	.005										
2009-02694- 14	09TEC104-25	4/16/2009	1288.9	Inside	acceptable	6	0.00969	-		<17	<0.005
Chrysotile All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Chrysotile >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.				
Amphibole All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Amphibole >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.	Non-Asbestos:	0 cnts		
Analytical Sensitivity:	.005										
2009-02694- 15	09TEC104-26	4/16/2009	1302.6	Inside	acceptable	6	0.00969	-		<17	<0.005
Chrysotile All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Chrysotile >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.				
Amphibole All:	0 str,	<17 str/mm2,	<0.005 str/cc.	Amphibole >5um:	0 str,	<17 str/mm2,	<0.005 str/cc.	Non-Asbestos:	0 cnts		
Analytical Sensitivity:	.005										

Average Str/mm2	0.0

Uwe Steimle

Analyst: UWE .. STEIMLE

Printed: 21-Apr-09

Original Print Date: 21-Apr-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: ✗ AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

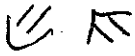
Client Smp #: **09TEC104-10**

Lab #: **2009-02694- 1** Vol (L): 1232.4

✗ MCE ___ PC Pore um: ___0.8 ✗ 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	(G11)	G12	G13	G14	G15
H6	H7	~~H8~~	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			(I12)	I13	I14	I15
J6	J7	J8	~~J9~~			J12	J13	J14	J15
K6	K7	K8	K9	~~K10~~	K11	K12	(K13)	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: ✗ Jeol N ___ Jeol S Mag: 20K or 15K Alignment: ✗ checked EDS: ___ calib ✗ not used

Ac. Volatage: ___100keV ✗ 120keV ___ keV

Fiber Counts:

Est. % Loading 3

Grid Storage # 1024 H10 Acceptable Prep ✗ (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
K10	NSD																									
J9	↓																									
H8	↓																									

Grid Storage # 1024 I1 Acceptable Prep ✗ (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

G11	NSD																									
I12	↓																									
K13	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

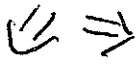
Client Smp #: **09TEC104-11**

Lab #: **2009-02694- 2** Vol (L): 1224.6

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 2 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 3

Grid Storage # 1024 I5 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
J15	NSD																									
L14	↓																									
M13	↓																									

Grid Storage # 1024 I7 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

H7	NSD																									
G9	↓																									
F11	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

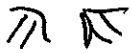
Client Smp #: **09TEC104-12**

Lab #: **2009-02694- 3** Vol (L): 1274.8

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 J2 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
H11	NSD																									
J12	↓																									
L13	↓																									

Grid Storage # 1024 J4 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

G10	NSD																									
I9	↓																									
K8	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/cc <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put notion under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

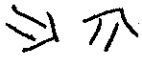
Client Smp #: **09TEC104-13**

Lab #: **2009-02694- 4** Vol (L): 1269.3

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	X G12	G13	G14	G15
H6	H7	H8	H9	X H10	H11	H12	H13	H14	H15
I6	I7	X I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	(J13)	J14	J15
K6	K7	K8	K9	K10	(K11)	K12	K13	K14	K15
L6	L7	L8	(L9)	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 1

Grid Storage # 1024 J8 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
I8	NSD																									
H10	↓																									
G12	↓																									

Grid Storage # 1024 J10 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

J13	NSD																									
K11	↓																									
L9	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/cc <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

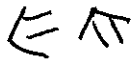
Client Smp #: **09TEC104-14**

Lab #: **2009-02694- 5** Vol (L): 1305.5

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 1

Grid Storage # 1024 K4 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
K11	N2																									
I12	↓																									
G13	↓																									

Grid Storage # 1024 K6 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

F10	N2																									
H9	↓																									
J8	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

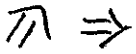
Client Smp #: **09TEC104-17**

Lab #: **2009-02694- 6** Vol (L): 1264.3

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	X H10	H11	H12	H13	H14	H15
I6	(I7)	I8	I9			X I12	I13	I14	I15
J6	J7	J8	(J9)			J12	J13	X J14	J15
K6	K7	K8	K9	K10	(K11)	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 1

Grid Storage # 1024 K10 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
H10	NSD																									
I8	↓																									
J14																										

Grid Storage # 1024 L1 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

K11	NSD																									
J9	↓																									
I7																										

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs	6
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

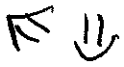
Client Smp #: **09TEC104-18**

Lab #: **2009-02694- 7** Vol (L): 1294.5

X MCE ___ PC Pore um: ___ 0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___ 100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 4

Grid Storage # 1024 L5 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
F14	NSD																									
G12	↓																									
H10	↓																									

Grid Storage # 1024 L7 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

K11	NSD																									
L9	↓																									
M7	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; OG=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** ~~04~~ 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

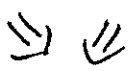
Client Smp #: **09TEC104-19**

Lab #: **2009-02694- 8** Vol (L): 1378.5

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	X E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	X G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	X I8	I9			I12	I13	O I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	O K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	O M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 M2 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
I8	NSD																									
G9	1																									
E10	↓																									

Grid Storage # 1024 M4 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

I14	NSD																									
K13	1																									
M12	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/cc <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

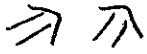
Client Smp #: **09TEC104-20**

Lab #: **2009-02694- 9** Vol (L): 1337.9

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 2 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 1

Grid Storage # 1024 M8 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
I9	NSD																									
K10	↓																									
M11	↓																									

Grid Storage # 1024 M10 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

J12	NSD																									
H11	↓																									
F10	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? Q	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle ***Date:*** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

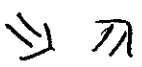
Client Smp #: **09TEC104-21**

Lab #: **2009-02694- 10** Vol (L): 1292.2

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ____ keV

Fiber Counts:

Est. % Loading 1

Grid Storage # 1024 N3

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
I8	N3																									
H10	↓																									
G12	↓																									

Grid Storage # 1024 N5

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

J3	N5																									
K11	↓																									
L9	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; CR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; CO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/cc <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

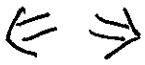
Client Smp #: **09TEC104-22**

Lab #: **2009-02694- 11** Vol (L): 1320.6

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	X	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	X	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	X	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 N9 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
M11	NSD																									
KR	↓																									
LB	↓																									

Grid Storage # 1024 02 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

I14	NSD																									
HR	↓																									
G10	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinke **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

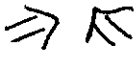
Client Smp #: **09TEC104-23**

Lab #: **2009-02694- 12** Vol (L): 1317.5

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	X G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			X I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	X K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 06

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
G11	NSD																									
H2	↓																									
K13	↓																									

Grid Storage # 1024 08

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

H9	NSD																									
28	↓																									
L7	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AF=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put section under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

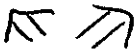
Client Smp #: **09TEC104-24**

Lab #: **2009-02694- 13** Vol (L): 1312.5

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	J9			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 P1 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NOPATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
K12	NSD																									
L12	↓																									
M8	↓																									

Grid Storage # 1024 P3 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

E11	NSD																									
G10	↓																									
I9	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; OO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/cc <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put notion under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

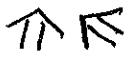
Client Smp #: **09TEC104-25**

Lab #: **2009-02694- 14** Vol (L): 1288.9

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot



E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	H8	H9	H10	H11	H12	H13	H14	H15
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	X			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 P7 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
J9	NSD																									
K11	↓																									
L13	↓																									

Grid Storage # 1024 P9 Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

I12	NSD																									
H10	↓																									
G8	↓																									

Abbreviations: NSD=No structures Detected; CH=chrysotile; GR=grunnerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uve Steimle ***Date:*** 4-21-09

Fiberquant Analytical Services

Fiberquant, Inc. 5025 S. 33rd St., Phoenix, Arizona 85040 602-276-6139 Fax 602-276-455

TEM Air Sample Count Sheet

Method: X AHERA ___ Modified AHERA ___ Yamate II ___ NIOSH 7402

Sample Information

Client: TALLPINES ENV CONSLTNG CO

Client Smp #: **09TEC104-26**

Lab #: **2009-02694- 15** Vol (L): 1302.6

X MCE ___ PC Pore um: ___0.8 X 0.45 ___ 0.4

Prep Map

Grid Orientation
Draw Asym Spot

E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
G6	G7	G8	G9	G10	G11	G12	G13	G14	G15
H6	H7	(H8)	H9	H10	H11	H12	H13	H14	X
I6	I7	I8	I9			I12	I13	I14	I15
J6	J7	J8	(J9)			J12	J13	J14	J15
K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
L6	L7	L8	L9	(L10)	L11	L12	L13	L14	L15
M6	X	X	M9	M10	M11	M12	M13	M14	M15
N6	N7	N8	N9	N10	N11	N12	N13	N14	N15

Grid Map
X denotes GO's on 1st grid; O denotes GO's on 2nd

Grid Information

#Grids Prepped: 3 GO Area: 0.00969 #GOs to Count 6

System Information

Str to 70/mm2 5

TEM: X Jeol N ___ Jeol S Mag: 20K or 15K Alignment: X checked EDS: ___ calib X not used

Ac. Volatage: ___100keV X 120keV ___ keV

Fiber Counts:

Est. % Loading 2

Grid Storage # 1024 E4

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

Location		Str. Type				Size		Morphology			Diffraction Data							EDXA Data							Ident.'n	
GO #	STR #	FIBER	BUNDLE	MATRIX	CLUSTER	Length	Width	TUBULAR	BLOCKY	Sketch	5.2 A Row Spacing	Estimated In-Row Spacing	CHRY	AMPH	NONASB	NO PATT	Negative #	Na	Mg	Si	Ca	Fe	Other	File #	ASBTYPE	NONASB
M7	NSD																									
M8	↓																									
H15	↓																									

Grid Storage # 1024 E6

Acceptable Prep X (>50% coverage, >50% intact, no folds, <5% opaque, 20 good GOs

L10	NSD																									
J9	↓																									
H8	↓																									

Abbreviations: NSD=No Structures Detected; CH=chrysotile; GR=grunerite; AN=anthophyllite; TR=tremolite; AP=amphibole; GO=grid opening; NA=non-asbestos

Totals:	CH All 0	CH > 5	AP All 0	AP > 5	NA All	# GOs 6	
Results:	Str/mm2 <17	Str/CC <0.005	If > 70 Str/mm2, Blank OK? ☐	(If Blank is contaminated, put action under notes)			

Notes:

Analyst: Uwe Steinle **Date:** 4-21-09

APPENDIX B
LEAD-BASED PAINT PAPERWORK

United States Environmental Protection Agency

This is to certify that

Tallpines Environmental Consulting Co.

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402(a)(1), and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226.

In the Jurisdiction of:

Arizona

This certification is valid from the date of issuance and expires April 18, 2012

AZ-2598-2

Certification #

APR 19 2009

Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

United States Environmental Protection Agency

This is to certify that

Tailpines Environmental Consulting Co.

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) section 402(a)(1), and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226.

In the Jurisdiction of:

Region 9 Tribal Lands

This certification is valid from the date of issuance and expires April 18, 2012

T9-2598-2

Certification #

APR 19 2009

Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

United States Environmental Protection Agency

This is to certify that

Patty R. Luttrell

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402(a)(1), and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as a:

Risk Assessor

In the Jurisdiction of:

Arizona

This certification is valid from the date of issuance and expires July 31, 2012

AZ-R-5515-2

Certification #

AUG 0 1 2009

Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

United States Environmental Protection Agency

This is to certify that

Patty R. Luttrell

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402(a)(1), and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as a:

Risk Assessor

In the Jurisdiction of:

Region 9 Tribal Lands

This certification is valid from the date of issuance and expires July 31, 2012

T9-R-5515-2

Certification #

AUG 0 1 2009

Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

United States Environmental Protection Agency

This is to certify that

Michael D Bell

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402(a)(1), and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as a:

Supervisor

In the Jurisdiction of:

Arizona

This certification is valid from the date of issuance and expires May 18, 2009

AZ-S-13861-1

Certification #

MAY 05 2006

Issued On

David R. Tomsovic For

Paula Bisson, Manager, Toxics Office

Communities and Ecosystems Division

Subject: [Fwd: Lab Report for 08TEC307.SPC - L381729]
From: tallpines@bmol.com
Date: Sun, 11 Jan 2009 11:06:15 -0700
To: fquinterosr@yahoo.com, Stan Schuman <stanjac@citlink.net>
BCC: Chad at Spray <chad@spraysystemseri.com>

Gentlemen, attached are the analytical test results for baseline sampling of soil and LBP components scheduled for removal and disposal at B104 and B116. The composite soil samples are reported with 4,900 mg/kg of total lead (soil sample -01L/B104), and 5,300 mg/kg of total lead (soil sample -02L/B116). EPA's standard for total lead in soil is 400 mg/kg in areas of bare soil and/or play areas. Because of the elevated total lead measured in the soil (composite samples collected beneath the dripline of each building), Tallpines recommends removal of 0.5 foot of topsoil a minimum of 6 feet out from the dripline for the entire perimeter of the each building. Using the plans, drawn to scale, the total cubic volume can be determined by measuring the length x width x 0.5 foot = cubic feet (CF). Each of the abatement Contractors supplied a CF price to remove and dispose of LBP contaminated soil. If the WM Apache Tribe has a low spot that needs to be infilled, the LBP contaminated soil can be used as long as noncontaminated soil (minimum 1 foot cover) is used to cover the contaminated soil. Otherwise, the abatement Contractor is to transport it for proper disposal.

If, after removing the LBP contaminated soil, the soil measures >400 mg/kg total lead, then the soil surrounding the 2 buildings is to be covered with a minimum 1 foot of noncontaminated topsoil, followed by a cover such as grass, concrete, asphalt, or gravel. With a 100+ year painting history, it is typical for LBP paint chips to end up in the soil which appears to be the story for these 2 buildings. Sometimes removal of 6-inches of topsoil does not meet the EPA standard for nonhazardous soil, so covering it after attempting to remove it is another option. The only restrictions are no vegetable or flower gardens (plants can uptake lead).

In reference to prior conversations regarding the removal of soil in the concrete areaway of B116 by Apache Tribe personnel, it has now been classified as being LBP contaminated. The soil in the areaway that surrounds @ 1/2 of the building is to be removed and disposed of by the abatement Contractor.

Bulk samples -03L and -04L were collected as composite samples of LBP components scheduled for removal and disposal (ex: picket fence at B104, and laundry room window sills at B116). Both of the composite samples, analyzed for TCLP for lead, measured below the laboratory detection limit for lead. TCLP equates to dripping acid rain on the sample to determine if the leachate (pregnant liquid) will contaminate the groundwater when the components are disposed of at a landfill. If the TCLP for total lead is <5.0 mg/L, then the waste is classified as nonhazardous. Based on the analytical test results, the LBP components scheduled for removal and disposal at both buildings are to be disposed of as nonhazardous waste. As per the contract specifications, this does NOT include LBP stripped from components, or Contractor PPE, etc. which is to be disposed of as hazardous waste.

Any questions, please call Patty at Tallpines

-------- Original Message --------
Subject: Lab Report for 08TEC307.SPC - L381729
Date: Tue, 6 Jan 2009 15:40:48 -0600
From:webmaster@envsci.com
To:tallpines@bmol.com

Please find enclosed a PDF file containing your laboratory report.

ESC is leading the laboratory industry with our internet data management tools. Please contact your

Visit ESC's "New" Data Management Web Site for all your reporting needs
http://www2.envsci.com/webclient/prot/login/login.cfm

**********NOTICE**********
Beginning Nov 1, 2005 , ESC will be charging for requested Rush Priority Return Shipment of sample c
****

TALLPINES ENVIRONMENTAL
10 W. Dale Avenue Flagstaff, AZ 86001

Alternate billing information:

Report to: P. Luttrell
Email to: Tallpinesa@mol.com

Project Description: B104 / B116
City/State Collected: Fort Apache, AZ

Phone: (928) 774-0060
FAX: (928) 774-0051

Client Project #: 08TEC307.SPC
ESC Key:

Collected by: T. Luttrell
Site/Facility ID#: B104 / B116
P.O.#: —

Collected by (signature): T. Luttrell
Packed on Ice: N Y

Rush? (Lab MUST Be Notified)
____ Same Day.....200%
____ Next Day.....100%
X Two Day.....50%

Date Results Needed:
Email? X No __Yes
FAX? __No X Yes

Analysis/Container/Preservative

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	Remarks/Contaminant	Sample # (lab only)
B104-01L	Composite	soil	½"	12/30/08	1:15pm	1		L381729-01
B116-02L	↓	↓	↓	↓	4:00pm	1		L381729-02
B104-03L	↓	soild	—	↓	4:15pm	1		-03
B116-04L	↓	↓	—	↓	3:45	1		-04

Chain of Custody Page 1 of 1

Prepared by:

ENVIRONMENTAL SCIENCE CORP.
12065 Lebanon Road
Mt. Juliet, TN 37122
Phone (615) 758-5858
Phone (800) 767-5859
FAX (615) 758-5859

D109

CoCode (lab use only)
Template/Prelogin
Shipped Via:

*Matrix: SS - Soil/Solid GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other _____

pH _____ Temp _____

Remarks:

963262521483

Flow _____ Other _____

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☑ FedEx ☐ Courier ☐	Condition: (lab use only)
T. Luttrell	12/31/08	4:30pm			OK
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 4°C	Bottles Received: 4 (Bags)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 1-2-09	Time: 0900
				pH Checked:	NCF:

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Report Summary

Tuesday January 06, 2009

Report Number:

Samples Received:

Client Project:

Description:

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By: Daphne R Richards

Daphne Richards, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375,DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910

Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

ENVIRONMENTAL
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Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Patty Luttrell
Tallpines Environmental Consulting
10 West Dale Ave.
Flagstaff, AZ 86001

January 06, 2009

ESC Sample # : L381729-01

Site ID : B104/B116

Project # : 08TEC307.SPC

Date Received : January 02, 2009
Description : B104/B116

Sample ID : B104-01L

Collected By :
Collection Date : 12/30/08 13:15

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Lead	4900	1.2	mg/kg	6010B	01/03/09	5

BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(POL)
Note:
The reported analytical results relate only to the sample submitted.

Reported: 01/06/09 13:02 Printed: 01/06/09 15:32

ENVIRONMENTAL
SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Patty Luttrell
Tallpines Environmental Consulting
10 West Dale Ave.
Flagstaff, AZ 86001

January 06,2009

ESC Sample # : L381729-02

Site ID : B104/B116

Project # : 08TEC307.SPC

Date Received : January 02, 2009
Description : B104/B116

Sample ID : B116-02L

Collected By : P. Luttrell
Collection Date : 12/30/08 16:00

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Lead	5300	1.2	mg/kg	6010B	01/06/09	5

BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.

Reported: 01/06/09 13:02 Printed: 01/06/09 15:32

ENVIRONMENTAL SCIENCE CORP.

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Patty Luttrell
Tallpines Environmental Consulting
10 West Dale Ave.
Flagstaff, AZ 86001

January 06,2009

ESC Sample # : L381729-03

Date Received : January 02, 2009
Description : B104/B116

Site ID : B104/B116

Sample ID : B104-03L

Project : 08TEC307.SPC

Collected By : P. Luttrell
Collection Date : 12/30/08 16:15

Parameter	Result	Det. Limit	Units	Limit	Method	Date/Time	By	Dil
TCLP Extraction	-				1311	01/05/09 0925	AJN	1
Lead	BDL	0.25	mg/l	5.0	6010B	01/06/09 0059	LAT	5

BDL - Below Detection Limit
Det. Limit - Estimated Quantitation Limit(EQL)
Limit - Maximum Contaminant Level as established by the US EPA
Note:
The reported analytical results relate only to the sample submitted.

Reported: 01/06/09 13:02 Printed: 01/06/09 15:32

ENVIRONMENTAL
SCIENCE CORP.

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Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Patty Luttrell
Tallpines Environmental Consulting
10 West Dale Ave.
Flagstaff, AZ 86001

January 06,2009

ESC Sample # : L381729-04

Site ID : B104/B116

Project : 08TEC307.SPC

Date Received : January 02, 2009
Description : B104/B116

Sample ID : B116-04L

Collected By : P. Luttrell
Collection Date : 12/30/08 15:45

Parameter	Result	Det. Limit	Units	Limit	Method	Date/Time	By	Dil
TCLP Extraction	-				1311	01/03/09 0745	MVE	1
Lead	BDL	0.050	mg/l	5.0	6010B	01/04/09 1453		1

BDL - Below Detection Limit
Det. Limit - Estimated Quantitation Limit(EQL)
Limit - Maximum Contaminant Level as established by the US EPA
Note:
The reported analytical results relate only to the sample submitted.

.
Reported: 01/06/09 13:02 Printed: 01/06/09 15:32

Attachment A
List of Analytes with QC Qualifiers

Sample Number	Work Group	Sample Type	Analyte	Run ID	Qualifier
L381729-03	WG401003	SAMP	TCLP Extraction	R583805	W2
	WG401131	SAMP	Lead	R582785	O

Attachment B
Explanation of QC Qualifier Codes

Qualifier	Meaning
O	(ESC) Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.
W2	(ESC) - Insufficient sample amount to perform method as required. Sample amount approved per client instruction.

Qualifier Report Information

ESC utilizes sample and result qualifiers as set forth by the EPA Contract Laboratory Program and as required by most certifying bodies including NELAC. In addition to the EPA qualifiers adopted by ESC, we have implemented ESC qualifiers to provide more information pertaining to our analytical results. Each qualifier is designated in the qualifier explanation as either EPA or ESC. Data qualifiers are intended to provide the ESC client with more detailed information concerning the potential bias of reported data. Because of the wide range of constituents and variety of matrices incorporated by most EPA methods,it is common for some compounds to fall outside of established ranges. These exceptions are evaluated and all reported data is valid and useable unless qualified as 'R' (Rejected).

Definitions

Accuracy - The relationship of the observed value of a known sample to the true value of a known sample. Represented by percent recovery and relevant to samples such as: control samples, matrix spike recoveries, surrogate recoveries, etc.

Precision - The agreement between a set of samples or between duplicate samples. Relates to how close together the results are and is represented by Relative Percent Differrence.

Surrogate - Organic compounds that are similar in chemical composition, extraction, and chromotography to analytes of interest. The surrogates are used to determine the probable response of the group of analytes that are chemically related to the surrogate compound. Surrogates are added to the sample and carried through all stages of preparation and analyses.

TIC - Tentatively Identified Compound: Compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates.

Summary of Remarks For Samples Printed
01/06/09 at 15:32:48

TSR Signing Reports: 371
R4 - Rush: Three Day

Sample: L381729-01 Account: TALPINFAZ Received: 01/02/09 09:00 Due Date: 01/07/09 00:00 RPT Date: 01/06/09 13:02

Sample: L381729-02 Account: TALPINFAZ Received: 01/02/09 09:00 Due Date: 01/07/09 00:00 RPT Date: 01/06/09 13:02

Sample: L381729-03 Account: TALPINFAZ Received: 01/02/09 09:00 Due Date: 01/07/09 00:00 RPT Date: 01/06/09 13:02

Sample: L381729-04 Account: TALPINFAZ Received: 01/02/09 09:00 Due Date: 01/07/09 00:00 RPT Date: 01/06/09 13:02

Subject: Re: Estimate for LBP Dipped Components to be Tested in Phoenix
From: tallpines@bmol.com
Date: Thu, 09 Apr 2009 10:39:00 -0700
To: Dave Kennedy <DKennedy@spray-eri.com>

Dave Kennedy wrote:

> That would work. Allison's 109 S. Perry
> Tempe
> About what time do you think? I will let them know you are coming and myself or Ken will meet your person.
>
> Thanks,
> Dave

Looks like Michael Bell will be there at 12:30pm. Should be interesting. Thanks for responding so quickly, I was afraid you might be in the field all day... Patty

---

From: tallpines@bmol.com [mailto:tallpines@bmol.com]
Sent: Thursday, April 09, 2009 9:54 AM
To: Dave Kennedy
Subject: Re: Estimate for LBP Dipped Components to be Tested in Phoenix

Dave Kennedy wrote:

> Patty,
>
> I stopped by there yesterday and we are looking the end of next week.
> The ones they had done looked pretty good. There are a few pieces that
> have some residual paint deep in some cracks, I told them to try
> redipping but I also do not want to damage the doors by gouging paint
> out of these cracks.
>
> Thanks,
> Dave

Thanks for the update Dave. We actually have 2 trips budgeted for testing stripped LBP components in Phoenix. What would you think of me sending an inspector down tomorrow to test what has already been dipped followed by some limited wipe samples? I realize that clearances on stripped LBP components are visual only, but it would give me additional information regarding the thoroughness of the chemical dip. And our inspector will be able to XRF test cracks with residual paint to determine if this is an issue. The XRF reads 3/8" deep but whether or not the reading would be >1.0 mg/cm2 is an unknown at this point. If you are in agreement that we go down tomorrow, email me the address and contact info. Thxs, Patty

> -----Original Message-----
> From: tallpines@bmol.com [mailto:tallpines@bmol.com]
> Sent: Wednesday, April 08, 2009 5:00 PM
> To: Dave Kennedy
> Subject: Estimate for LBP Dipped Components to be Tested in Phoenix
>
> Dave, by any wild chance will the LBP components in Phoenix (to be
> dipped) be ready for testing this Friday, or did you say next week? Our
> hygienist will be running TEMs tomorrow in the B116 basement boiler
> room, and re-testing for leaded dust in B104. Will email results Friday
> afternoon. Thxs, Patty

Subject: [Fwd: FQ 0902489-B104 & B116 LBP Components / 0902492-B104 Fort Apache]
From: tallpines@bmol.com
Date: Mon, 13 Apr 2009 17:01:03 -0700
To: fquinterosr@yahoo.com, Mickey Estrada <mickeyestrada@yahoo.com>, Dave Kennedy <dkennedy@spraysystemseri.com>, Stan Schuman <stanjac@citlink.net>

Gentlemen, attached are the lead-based paint (LBP) analytical test results from two different sampling events for B104. The first .pdf is for Tallpines' trip to Allison's Furniture in Phoenix last Friday, the location of chemical dipping of LBP components to remove the paint. Tallpines' purpose was to inspect the thoroughness of the removal, and to test the components before they were reinstalled in B104 and B116.

As it turns out, the XRF testing measured elevated counts of lead on the tops and bottoms (parallel to the wood grain) of stripped windows and doors. Wipe samples were collected and sent to Fiberquant Analytical as a backup analysis (attached). The laboratory also reports elevated counts of lead. There are no HUD clearance standards for LBP components such as doors and windows, only floors and window sills. The fact remains that if these doors and windows are reinstalled, and later tested with an XRF analyzer, they will register as LBPs. I can only conclude that the methylene chloride vat that the components are being dipped into has not had the lead waste/residue cleaned out recently, and it is being absorbed by the porous wood when it is dipped.

I will be in Sedona tomorrow on business, so will not be able to contact EPA Region 9. I want to ask what they recommend doing in this instance, because although the LBP is being stripped, elevated lead counts are still present in the porous wood. In terms of LBP hazards, this will not work for friction (window) or impact (door) surfaces in an occupied building.

The 2nd .pdf involves the 2nd re-test conducted at B104 for leaded dust on floors and window sills. All recleaned components failed again except for a sanded wooden window sill (wipe sample 104-56; 210 ug/ft2 versus the HUD clearance standard of 250 ug/ft2 for sills). The portion of sanded floor (wipe sample 104-57) is reported with 41 ug/ft2 versus the HUD clearance standard of 40 ug/ft2 for floors; failed. It appears that sanding may be the best answer to removing the embedded leaded dust on the floors and sills inside this building. Dave mentioned that a change order would be warranted if Spray had to mechanically sand the floors and subsequently reclean the entire interior of the building. One other option to add are the ceilings; they need to be encapsulated following the sanding so that leaded dust cannot potentially contaminate the floors.

I will address the stripping of LBP components with EPA on Wednesday and email the results of that discussion. Any questions, just know that I cannot respond until Wednesday.

Another issue is the EPA ID number that Dave at Spray needs from the WMA Tribe. Someone at the Tribe needs to generate and sign this paperwork so he can dispose of the hazardous waste (stripped LBP chips).

Patty at Tallpines
-------- Original Message --------
Subject:FQ 0902489-B104 & B116 LBP Components / 0902492-B104 Fort Apache
Date: Mon, 13 Apr 2009 15:34:51 -0700
From: Karen Grant / KLK <ke2grant@fiberquant.com>
Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aaw

As per Dave's request, he wants us to test wood that has been scraped (B104 windows and doors), but not dipped. I called one of our inspectors (they are testing B116 today), and asked that they conduct wipe sampling of a door and window that have been scraped by Spray in B104. He is to sample a clearly encapsulated door/window, and sample a door/window with no encapsulant. Scraped components at B104 were reportedly encapsulated with Lock Down Encapsulant; a penetrating encapsulant. Based on the results, we should be able to determine if lead has leached from the paint to the porous wood components (unnincapsated), or if the Lock Down Encapsulant is working. We will RUSH results on these 4 samples with results Monday afternoon. It may turn out that components encapsulated with Lock Down do not measure elevated counts of residual lead, in which case no changes will need to be made to products being used. Spray will continue encapsulating stabilized and stripped components (friction and impact surfaces).

Regardless of the outcome, a penetrating encapsulant/primer needs to be applied to LBP components in both B104 and B116 prior to repainting. I spoke to a Contractor in New Jersey that sells encapsulant products. He recommends using FiberTech F50; a penetrating primer. He stated that it is used to prime LBP components prior to repainting. He said that what makes it different is that is has an adhesion 10 times stronger than any other primer so that the primer is drawn deep into the wood grain.

Please email any questions or call 928-774-0060. Thanks, Patty at Tallpines

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From: tallpines@bmol.com [mailto:tallpines@bmol.com]
Sent: Monday, April 13, 2009 5:01 PM
To: fquinterosr@yahoo.com; Mickey Estrada; Dave Kennedy; Stan Schuman
Subject: [Fwd: FQ 0902489-B104 & B116 LBP Components / 0902492-B104 FortApache]

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Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aaw
Date Rec'd:	4/13/09
Qty Rec'd:	3. 20
TAT Req'd:	rush

Subject: Re: [Fwd: FQ 0902489-B104 & B116 LBP Components / 0902492-B104 FortApache]
From: tallpines@bmol.com
Date: Thu, 16 Apr 2009 12:32:01 -0700
To: Dave Kennedy <DKennedy@spray-eri.com>
CC: FQUINTEROSR@YAHOO.COM, emersonconst@hotmail.com, Mickey Estrada <mickeyestrada@yahoo.com>, Stan Schuman <stanjac@citlink.net>

Dave Kennedy wrote:

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Method:	aaw
Date Rec'd:	4/13/09
Qty Rec'd:	3. 20
TAT Req'd:	rush

Subject: Re: [Fwd: FQ 0902489-B104 & B116 LBP Components / 0902492-B104 FortApache]
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Date: Fri, 17 Apr 2009 15:23:32 -0700
To: Dave Kennedy <DKennedy@spray-eri.com>
CC: FQUINTEROSR@YAHOO.COM, emersonconst@hotmail.com, Mickey Estrada <mickeyestrada@yahoo.com>, Stan Schuman <stanjac@citlink.net>

Dave Kennedy wrote:

> Patty,
>
> Since the doors were tested using XRF don't you think we should also use XRF on the non dripped wood for comparison before making any final decisions?
>
> Thanks,
> Dave

Sounds reasonable, but my inspectors didn't have the XRF with them this week. I suspect we will be back at Fort Apache next Thursday or Friday?, so will bring the XRF then and test the components we wiped yesterday afternoon. The dust samples are being Fed Ex to the lab today, so will have the results on the 4 wipes components Monday afternoon (2 scraped windows; most windows and doors are in Phoenix for the chemical dip), and 2 walls stabilized and encapsulated by Spray (encapsulant is white). Will email the results Monday afternoon. The TEM results on B116 are expected on Tuesday, and the lead results on Wednesday. I am pretty sure the mouse allergen tests take a full 5 days before we receive the results. Have a good long weekend! Patty

---

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To: Dave Kennedy
Cc: FQUINTEROSR@YAHOO.COM; emersonconst@hotmail.com; Mickey Estrada; Stan Schuman
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To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aaw

(01)

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

Allison's Furniture

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC103.CLR
PROJECT NAME: B104 & B116 LBP Components
CLIENT/COMPANY: White Mountain Fort Apache Tribe c/o Tallpines
SAMPLER (SIGNATURE): [signature]
SAMPLER (PLEASE PRINT): Michael Bell

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT		AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B104/116-01	4/10/09	1:40	Field blank	—	X	—	—	—	X	—	—	4¾" x 4¾"	(Field blank)
B104/116-02	↓	1:44	Window Frame Top	—	X	—	—	—	X	—	—	25 in²	Window Frame
B104/116-03	↓	1:47	Door side (left)	—	X	—	—	—	X	—	—	25 in²	Door

RUSH

(RUSH)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
[signature]	4/10/09	5:15 PM	P. Buttrell	P. Buttrell	4/11/09	11am	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
Fed Ex 8684-7067-5630			Kathy Knowles	4/13/9	9:49

SAMPLE PROCESS TURNAROUND TIME
☒ RUSH, 24 HOURS ☐ NORMAL, 2-3 DAYS

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200902489

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 3 AA **Rec:** 4/13/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: B104 & B116 LBP Components **PO Number:** 09TEC103.CLR

Report Date: 4/13/2009 **Date Analyzed:** 4/13/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

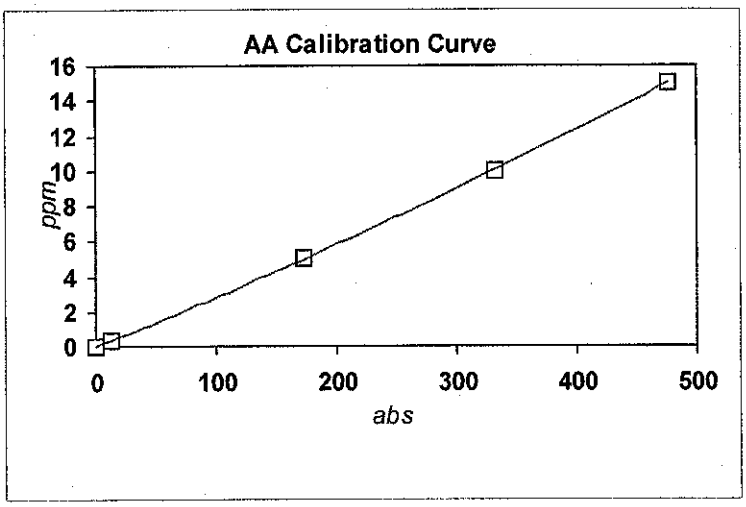
Pb

Run # 6745 **4/13/2009**

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	12
2	5	173
3	10	332
4	15	476

ax2	0.00000893
bx	0.02726509
c	-0.00974164
R2	0.99998874



Analysis Results:

Job Number:	200902489

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-02489-1	B104/116-01	4/10/2009	acceptable	0.157	0.0175	25	1	Pb	<48	<7.5	7.5
2009-02489-2	B104/116-02	4/10/2009	acceptable	4.34	3.8635	25	10	Pb	220	970	7.5
2009-02489-3	B104/116-03	4/10/2009	acceptable	4.34	8.6481	25	50	Pb	2500	11000	7.5

Analyst: MICHAEL A. COOK

Printed: 13-Apr-09

Original Print Date: 13-Apr-09

Larry S. Pierce, Approved Accreditation Signatory

Gentlemen, attached are the analytical test results for leaded dust measured in 30 wipe samples collected in B116 (10 wipes per floor) last Friday. Both the basement and 2nd floors contain residual elevated counts of leaded dust, but the 1st/main floor is reported with leaded dust levels <40ug/ft2 which is the clearance standard for floors. The basement needs to be recleaned (floors and sills), and the 2nd floor stairwell and floors need to be recleaned. If Spray can complete the recleaning by next Tuesday, we will re-test the basement and 2nd floor (20 wipes). Dave, let me know if this will work for your schedule. Thanks, Patty

-------- Original Message --------
Subject:FQ 0902696 /WMAT/B116/Boy's Dormitory
Date: Thu, 23 Apr 2009 14:29:13 -0700
From: Karen Grant / JAL <ke2grant@fiberquant.com>
Reply-To: Karen Grant <ke2grant@fiberquant.com>
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Karen G ☐ Kathy K ☐ Kathy T ☐

Method / Type:	aa
Date Received:	04/20/09
Qty Received:	30
TAT Requested:	2-3day

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-abatement dust sampling (Lead)	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date:	April 15, 2009
		Time:	11:08 am
Contractor:	Spray Systems	Work Area:	B116/2nd Floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Rick Liddle (Print Name) _____ (Signature) 4-16-09 (Date)

C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Paint scraped and encapsulated on walls & floors. Sewer pipes in place & not encapsulated. Stairwells very clean. Nice job.

Tallpines' Representative: Sharon Lynne (Print Name) _____ (Signature) 4/16/09 (Date)

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104.CLR | PROJECT NAME: B116 / Boy's Dormitory
CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines
SAMPLER (SIGNATURE): | SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-01	4/6/09	10:00	Field blank		X				X		4.5"x4.5"	Field blank
B116-02		10:15	Basement - SE Room		X				X		144 in²	(floor)
B116-03		10:17	Basement - SE Room		X				X			(window sill)
B116-04		10:18	Basement - S. Room		X				X			(floor)
B116-05		10:21	Basement - W. Room		X				X			
B116-06		10:23	Basement - E. Room		X				X			
B116-07		10:25	Basement - NE Room		X				X			(window sill)
B116-08		10:27	Basement - NW Room		X				X			(floor)
B116-09		10:29	Basement - N. Room		X				X			
B116-10		10:33	Basement - NE hall		X				X			
B116-11		12:00	1st floor - SE room		X				X			(floor)
B116-12		12:03	1st floor - SE room		X				X			(window sill)
B116-13		12:05	1st floor - SW room		X				X			(floor)
B116-14		12:07	1st floor - SW room		X				X			
B116-15		12:08	1st floor - N. room		X				X			
B116-16		12:11	1st floor - Restroom		X				X			
B116-17		12:14	1st floor - NW Room		X				X			
B116-18		12:16	1st floor - N. Room		X				X			

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	4/16/09	6 pm	T. Wilfred
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)
FedEx 8684-7067-5618			Kathy Kendrick

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
T. Wilfred	4/20/09	11:23	

DATE	TIME	RECEIVED BY (SIGNATURE)
4/7/09	1pm	

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

LEAD SAMPLE CHAIN-OF-CUSTODY

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO. 09TEC104.CLR | PROJECT NAME B116 / Boy's Dormitory

CLIENT/COMPANY White Mountain Apache Tribe c/o Tallpines

SAMPLER (SIGNATURE) | SAMPLER (PLEASE PRINT) Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-19	4/16/09	12:08	1st Floor - NW Room		X				X		144 IN²	(floor)
B116-20		12:21	1st Floor - NW Room		X				X			(window sill)
B116-21		10:42	2nd floor S. Stairwell		X				X			(Stair tread)
B116-22		10:44	2nd floor - NE Room		X				X			(floor
B116-23		10:47	2nd floor - NW Room		X				X			
B116-24		10:49	2nd floor - W. Room		X				X			
B116-25		10:51	2nd floor - W. Room		X				X			
B116-26		10:53	2nd floor - E. Room		X				X			
B116-27		10:56	2nd floor - SW Room		X				X			
B116-28		10:58	2nd floor - SW Room		X				X			(window sill)
B116-29		11:00	2nd floor - SE Room		X				X			(floor)
B116-30		11:03	2nd floor - N. Stairwell		X				X			(Stair tread)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
	4/16/09	6pm			
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
FedEx 8684-7067-5618			Kathy Knowles	4/20/9	11:23

RELINQUISHED BY (SIGNATURE) | DATE 4/17/09 | TIME 1pm | RECEIVED BY (SIGNATURE)

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200902696

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060
FAX: (928) 774-0051

 # Samples: 30 AA **Rec:** 4/20/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: WMAT/B116/Boy's Dormitory **PO Number:** 09TEC104.CLR

Report Date: 4/23/2009 **Date Analyzed:** 4/23/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

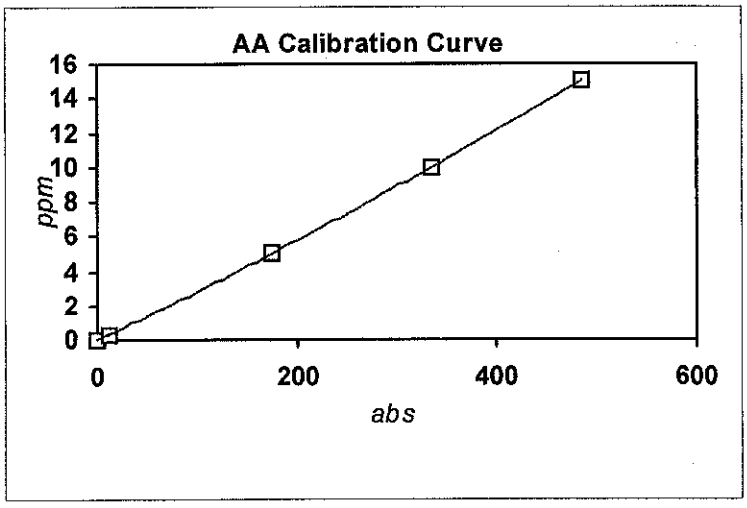
Pb

Run # 6760 *4/22/2009*

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	12
2	5	175
3	10	335
4	15	486

ax2	0.00000698
bx	0.02751924
c	-0.01710305
R2	0.99999457



Analysis Results:

Job Number:	200902696

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-02696- 1	B116-01	3/16/2009	acceptable	0.14	0.0655	25	1	Pb	<54	<7.5	7.5
2009-02696- 2	B116-02	3/16/2009	acceptable	1	1.6308	25	1	Pb	41	41	7.5
2009-02696- 3	B116-03	3/16/2009	acceptable	1	12.839	25	1	Pb	320	320	7.5
2009-02696- 4	B116-04	3/16/2009	acceptable	1	1.5742	25	1	Pb	39	39	7.5
2009-02696- 5	B116-05	3/16/2009	acceptable	1	8.5505	25	1	Pb	210	210	7.5
2009-02696- 6	B116-06	3/16/2009	acceptable	1	5.0425	25	1	Pb	130	130	7.5
2009-02696- 7	B116-07	3/16/2009	acceptable	1	2.4299	25	1	Pb	61	61	7.5
2009-02696- 8	B116-08	3/16/2009	acceptable	1	2.2291	25	10	Pb	560	560	7.5
2009-02696- 9	B116-09	3/16/2009	acceptable	1	1.2917	25	1	Pb	32	32	7.5
2009-02696- 10	B116-10	3/16/2009	acceptable	1	2.5162	25	1	Pb	63	63	7.5
2009-02696- 11	B116-11	3/16/2009	acceptable	1	0.5639	25	1	Pb	14	14	7.5
2009-02696- 12	B116-12	3/16/2009	acceptable	1	0.5917	25	1	Pb	15	15	7.5
2009-02696- 13	B116-13	3/16/2009	acceptable	1	0.2035	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 14	B116-14	3/16/2009	acceptable	1	0.9266	25	1	Pb	23	23	7.5
2009-02696- 15	B116-15	3/16/2009	acceptable	1	0.1483	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 16	B116-16	3/16/2009	acceptable	1	1.2636	25	1	Pb	32	32	7.5
2009-02696- 17	B116-17	3/16/2009	acceptable	1	0.1207	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 18	B116-18	3/16/2009	acceptable	1	0.3695	25	1	Pb	9.2	9.2	7.5
2009-02696- 19	B116-19	3/16/2009	acceptable	1	0.6752	25	1	Pb	17	17	7.5
2009-02696- 20	B116-20	3/16/2009	acceptable	1	0.4805	25	1	Pb	12	12	7.5
2009-02696- 21	B116-21	3/16/2009	acceptable	1	6.8970	25	1	Pb	170	170	7.5
2009-02696- 22	B116-22	3/16/2009	acceptable	1	0.1483	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 23	B116-23	3/16/2009	acceptable	1	0.0931	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 24	B116-24	3/16/2009	acceptable	1	1.6308	25	1	Pb	41	41	7.5
2009-02696- 25	B116-25	3/16/2009	acceptable	1	0.8707	25	1	Pb	22	22	7.5
2009-02696- 26	B116-26	3/16/2009	acceptable	1	0.4527	25	1	Pb	11	11	7.5
2009-02696- 27	B116-27	3/16/2009	acceptable	1	0.425	25	1	Pb	11	11	7.5
2009-02696- 28	B116-28	3/16/2009	acceptable	1	1.3481	25	1	Pb	34	34	7.5
2009-02696- 29	B116-29	3/16/2009	acceptable	1	0.1759	25	1	Pb	<7.5	<7.5	7.5
2009-02696- 30	B116-30	3/16/2009	acceptable	1	1.0387	25	1	Pb	26	26	7.5

Analysis Results:

Job Number:	200902696	AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)

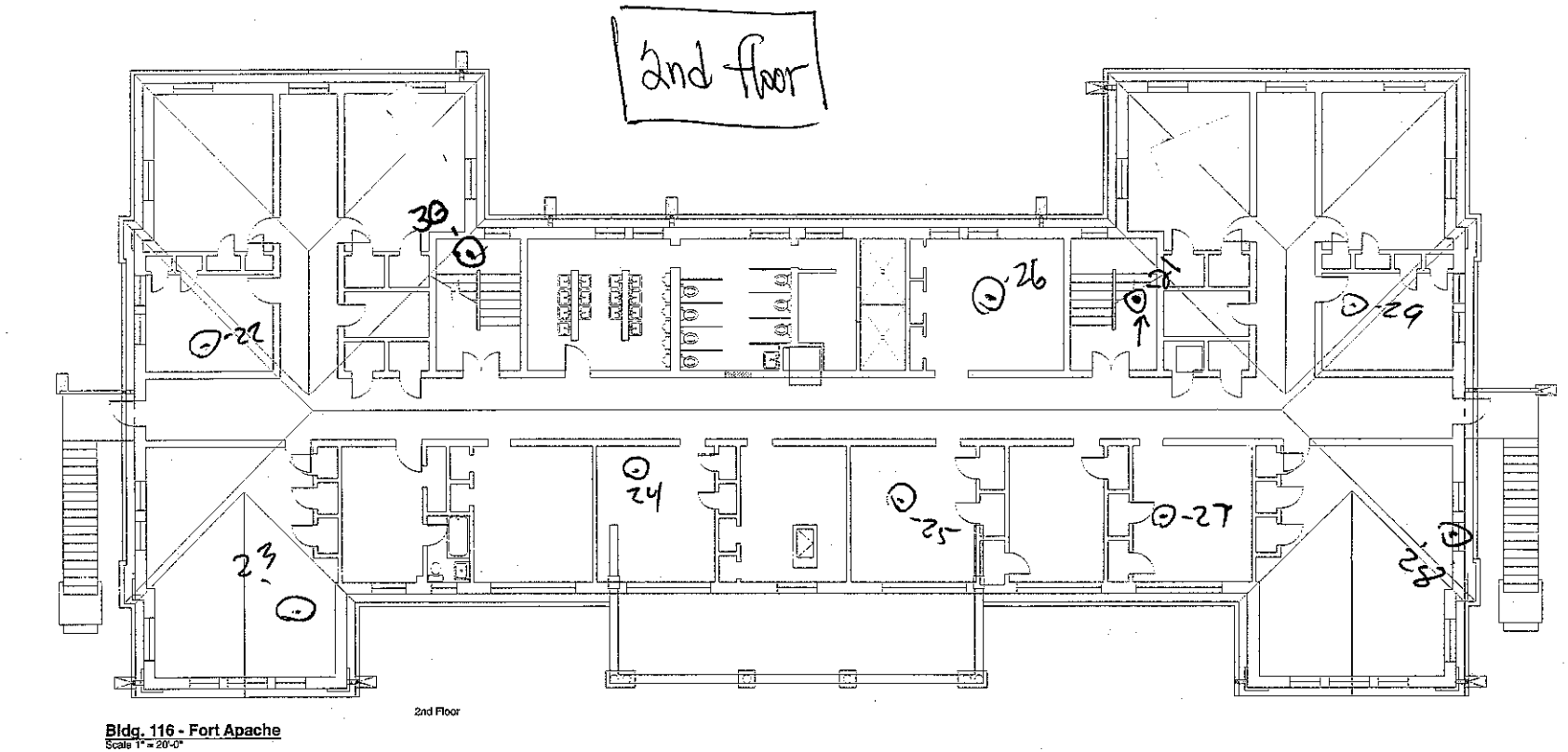
Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 23-Apr-09

Original Print Date: 23-Apr-09

Larry S. Pierce, Approved Accreditation Signatory



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement Wipe Samples for Lead
B116/Boys Dorm / 2nd floor
Tallfires Job No. 09TEC104.CLR

(03)

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Abatement Dust Sampling (Lead)	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	April 16, 2009 11:00 am
Contractor:	Spray Systems	Work Area:	B116/1st Floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Rick Liddle (Print Name) _____ (Signature) 4-16-09 (Date)

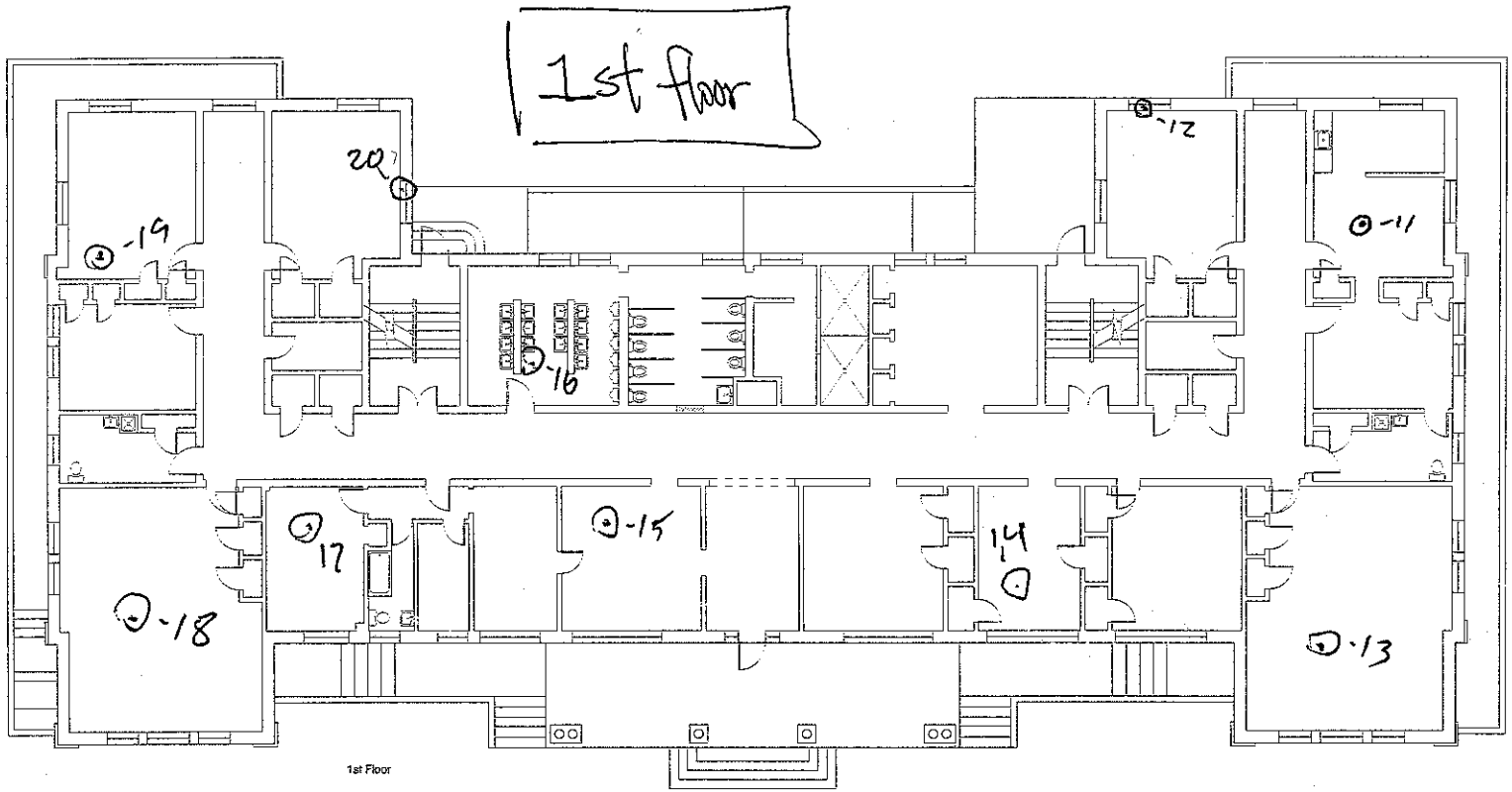
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: No visible debris or paint chips or flakes on walls or floors. Walls scraped & encapsulated. Sewer pipes not removed.

Tallpines' Representative: Aaron Lynne (Print Name) _____ (Signature) 4/16/09 (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement Wipe Samples for Lead
B116 (Boy's Dorm) - 1st Floor
Tallgrass Job No. 09TEC104.CLR

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Abatement Dust Sampling (Lead)	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	April 16, 2009 11:00 am
Contractor:	Spray Systems	Work Area:	B116/Basement

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Rick Liddle (Print Name) _____ (Signature) 4-16-09 (Date)

C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

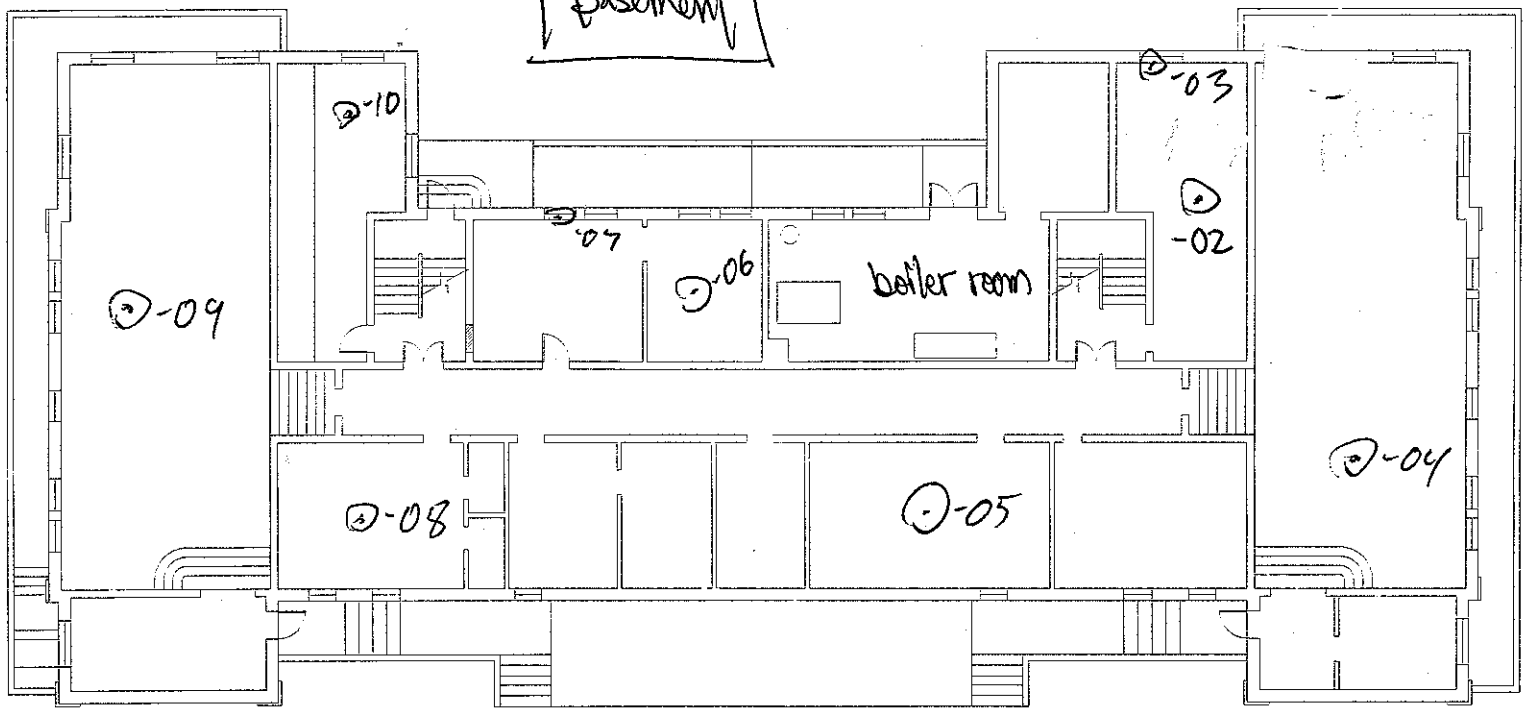
D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Handrail on S. room in place. Some peeled paint on N. room stairwell. No debris on ground. Walls scraped & encapsulated. Sills still in place in laundry room. Boiler room coal room not cleaned out.

Tallpines' Representative: Sharon Lynne (Print Name) _____ (Signature) 4/16/09 (Date)

N

Basement



Basement

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Abatement Wipe Samples for Lead
B116/Boys Dorm U - BASEMENT
Tetratech Job No. 09TEC104.CLR

Gentlemen, attached are the analytical test results for a re-test conducted for leaded dust on the 2nd floor and basement of B116. The 2nd floor has cleared (samples -41 through -49), but the basement requires additional cleaning (samples -32 through -40). The basement south stair tread (sample -39; 40 ug/ft2 of leaded dust) cleared, but the basement north stair landing (sample -40; 320 ug/ft2) needs to be recleaned. Contractors, if authorized by Spray, can enter the 1st and 2nd floors, but cannot use the basement north stairs. The coal room floor (sample -50; 57 ug/ft2) needs to be recleaned. Also, Rick needs to remove the mold from the interior wall near the B116 southwest entry - this was missed during the last recleaning. **The B116 basement, coal room, 1st floor Room M-3 (allergen results pending), and north basement stairs are to remain restricted until additional cleaning and successful test results are received from the laboratory.**

Composite soil sample results (B104 and B116) are still pending, as well as the allergen results for B116 Room M-3 and the coal room.

Dave, Tallpines can conduct a re-test for leaded dust in the basement on Tuesday or Thursday of next week. Let me know your schedule. Thanks, Patty

-------- Original Message --------
Subject:FQ 090 2940 /WMAT/B116/Fort Apache
Date: Thu, 30 Apr 2009 10:11:45 -0700
From: Karen Grant / JAL <ke2grant@fiberquant.com>
Reply-To: Karen Grant <ke2grant@fiberquant.com>
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Karen G ☐ Kathy K ☐ Kathy T ☐

Method / Type:	aa
Date Received:	04/29/09
Qty Received:	20
TAT Requested:	2-3day

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200902940

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 20 AA **Rec:** 4/29/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104R.CLR

Report Date: 4/30/2009 **Date Analyzed:** 4/30/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

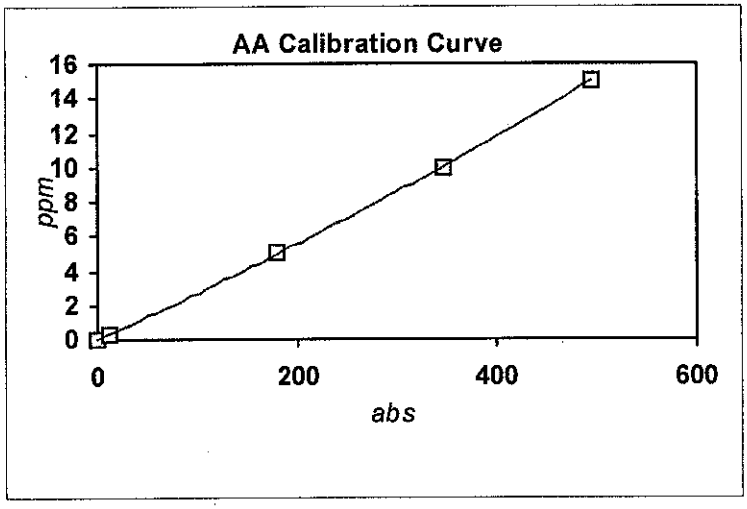
Pb

Run # 6770 *4/29/2009*

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	13
2	5	180
3	10	347
4	15	494

ax2	0.000009
bx	0.02589565
c	-0.00949095
R2	0.99995105



Analysis Results:

Job Number:	200902940

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-02940-1	B116-31	4/28/2009	acceptable	0.14	0.0683	25	1	Pb	<54	<7.5	7.5
2009-02940-2	B116-32	4/28/2009	acceptable	1	3.9061	25	1	Pb	98	98	7.5
2009-02940-3	B116-33	4/28/2009	acceptable	1	1.6306	25	1	Pb	41	41	7.5
2009-02940-4	B116-34	4/28/2009	acceptable	1	1.7388	25	1	Pb	43	43	7.5
2009-02940-5	B116-35	4/28/2009	acceptable	1	6.2427	25	1	Pb	160	160	7.5
2009-02940-6	B116-36	4/28/2009	acceptable	1	3.8207	25	1	Pb	96	96	7.5
2009-02940-7	B116-37	4/28/2009	acceptable	1	2.6978	25	1	Pb	67	67	7.5
2009-02940-8	B116-38	4/28/2009	acceptable	1	7.4236	25	1	Pb	190	190	7.5
2009-02940-9	B116-39	4/28/2009	acceptable	1	1.6036	25	1	Pb	40	40	7.5
2009-02940-10	B116-40	4/28/2009	acceptable	1	12.723	25	1	Pb	320	320	7.5
2009-02940-11	B116-41	4/28/2009	acceptable	1	0.3026	25	1	Pb	7.6	7.6	7.5
2009-02940-12	B116-42	4/28/2009	acceptable	1	0.381	25	1	Pb	9.5	9.5	7.5
2009-02940-13	B116-43	4/28/2009	acceptable	1	0.0683	25	1	Pb	<7.5	<7.5	7.5
2009-02940-14	B116-44	4/28/2009	acceptable	1	0.1202	25	1	Pb	<7.5	<7.5	7.5
2009-02940-15	B116-45	4/28/2009	acceptable	1	0.5646	25	1	Pb	14	14	7.5
2009-02940-16	B116-46	4/28/2009	acceptable	1	0.3026	25	1	Pb	7.6	7.6	7.5
2009-02940-17	B116-47	4/28/2009	acceptable	1	0.5646	25	1	Pb	14	14	7.5
2009-02940-18	B116-48	4/28/2009	acceptable	1	0.4071	25	1	Pb	10	10	7.5
2009-02940-19	B116-49	4/28/2009	acceptable	1	0.2504	25	1	Pb	<7.5	<7.5	7.5
2009-02940-20	B116-50	4/28/2009	acceptable	1	2.2841	25	1	Pb	57	57	7.5

Analysis Results:

Job Number:	200902940	AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 30-Apr-09

Original Print Date: 30-Apr-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

Subject: [Fwd: FQ 0902941,2942 /WMAT/B116,104/Fort Apache]
From: tallpines@bmol.com
Date: Fri, 01 May 2009 13:36:18 -0700
To: Franklin Quintero <fquinterosr@yahoo.com>, Jimmy Emerson <emersonconst@hotmail.com>, Dave Kennedy <dkennedy@spraysystemseri.com>, Stan Schuman <stanjac@citlink.net>, Mickey Estrada <mickeyestrada@yahoo.com>, Richard Liddle <rliddleaz@gmail.com>

Gentlemen, attached are the analytical test results for composite soil samples collected at B104 and B116. Soil sample B104-65, collected along the perimeter/dripline of B104, is reported with 900 parts per million (ppm) of total lead. Soil sample B116-51, collected from the perimeter of B116, is reported with 140 ppm of total lead. The HUD clearance standard for bare soil is 2,000 ppm. Congratulations! No further work is warranted on soil, other than removal of LBP fence/posts on north side of B104 (pickup LBP chips, if present). Thanks, Patty

-------- Original Message --------
Subject:FQ 0902941,2942 /WMAT/B116,104/Fort Apache
Date: Fri, 01 May 2009 12:52:26 -0700
From: Karen Grant / KLK <ke2grant@fiberquant.com>
Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aa
Date Rec'd:	04/29/09
Qty Rec'd:	
TAT Req'd:	2-3day

200902941 TPEC.pdf	**Content-Type:** application/pdf **Content-Encoding:** base64

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Soil

JobNumber: 200902941

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 1 AA **Rec:** 4/29/2009 **Method:** Modified SW 846 3050b/7420 AA digestion/analysis of soil

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104.CLR

Report Date: 5/1/2009 **Date Analyzed:** 5/1/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAs

The received samples were analyzed for metals (total) using "Test Methods for Evaluating Solid Waste" (SW 846, December 1996 updates). The extraction/digestion method was SW 3050b. The analytical method is "flame atomic absorption, direct aspiration", SW 7420. Briefly the procedures are as follows. The incoming samples are first dried at 95 degrees C, then passed through 10 and 60 mesh sieves. A sub-sample is weighed to 0.0001 gm into a 50ml centrifuge tube. To the run stream are added the quality assurance samples described below. Six mls of concentrated HNO3 and one ml of 30% H2O2 are added to each container. The tubes are caped and heated for 1 hour at 95 deg. C. After cooling, the contents of the centrifuge tube are brought up to exactly 25 mls, completing the digestion/extraction.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelengths and other instrumental settings are set according to the manufacturer's recommendations, or as otherwise specified in the published method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ppm (ug/gm) for each sample is calculated from the sub-sample weight, extract volume, and extract concentration.

The results from this analysis is generally compared to either a 400 (high contact) or 1200 (non-high contact) ppm concensus standard as lead-containing. The expected coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, samples significantly smaller than 0.2 gm may give results too near the 400 ppm standard to be reliable. Problems in analysis or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in soil (AIHA Lab # 101593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in soil. Results for any other metals, if reported, are not covered by accreditation. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

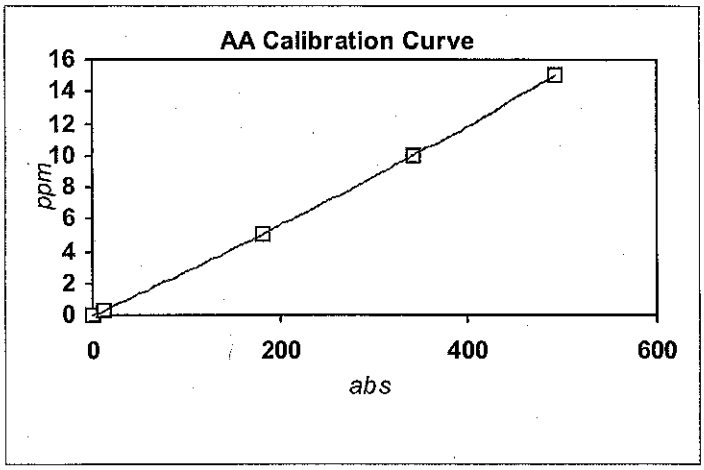
Pb

Run # 6774 ***5/1/2009***

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	13
2	5	181
3	10	342
4	15	493

ax2	0.00000837
bx	0.02637242
c	-0.02487893
R2	0.99998597



Analysis Results:

Job Number:	200902941

AAs

Lab Number	Client Number	Date	Condition	Weight (gm)	ug/ml	ml	Dil	Analyte	ppm	-	RL(ppm)
2009-02941-1	B116-51	4/28/2009	acceptable	0.2145	1.206	25	1	Pb	140	-	35

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 01-May-09

Original Print Date: 01-May-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

2nd re-test

Gentlemen, attached are the analytical results for the 2nd re-test conducted for leaded dust in the basement and boiler coal room at B116. The coal room, sample -61 with a reported 33 ug/ft2, is the only floor sample that cleared. The remaining dust samples -53 through -60 were collected in various landings/rooms inside the basement, and are reported with elevated lead levels above the HUD clearance level of 40 ug/ft2. Not sure why the basement continues to measure elevated leaded dust. Our inspector said the re-cleaning of the floor looked good, and the wipes appeared to be clean. Tallpines authorizes release of the boiler coal room, but access is denied to the basement north stair landing, stairs, and entire basement until additional cleaning and testing can be conducted.

Dave, let me know your schedule for re-cleaning. We can be available next Wednesday, Thursday or Friday for the 3rd re-test. Any questions, or comments, please call or email. Thanks, Patty

-------- Original Message --------
Subject:FQ 0903130/WMAT/B116/Fort Apache /
Date: Thu, 07 May 2009 13:18:04 -0700
From: Karen Grant / JAL <ke2grant@fiberquant.com>
Reply-To: Karen Grant <ke2grant@fiberquant.com>
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Karen G ☐ Kathy K ☐ Kathy T ☐

Method / Type:	aa
Date Received:	05/06/09
Qty Received:	10
TAT Requested:	2-3day

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

Re-Test No. 1

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION			
Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time: 10:30 am	April 28, 2009
Contractor:	Spray Systems	Work Area:	B116/Basement RE-TEST NO. 1

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Rick Liddle 4-28-09
(Print Name) (Signature) (Date)

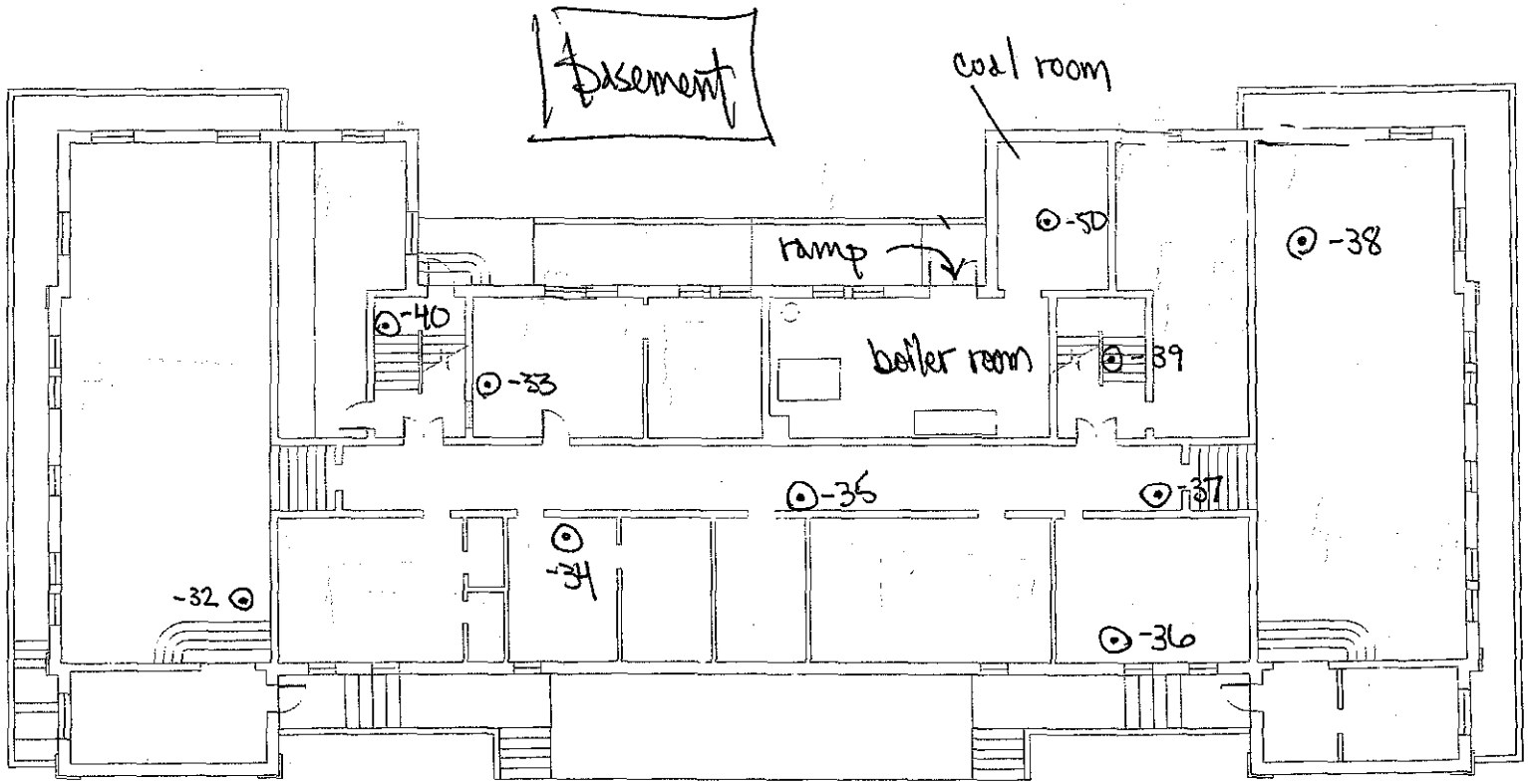
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Window Sills in Laundry room are removed. No Chipping or flaking paint visible. Encapsulant is thorough. Looks good & clean.

Tallpines' Representative: Sharon Lynne 4/28/09
(Print Name) (Signature) (Date)



Basement

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Re-Test No. 1

Post-Abatement Wipe Samples for Lead
B116/ Boys Dorm U - BASEMENT
Tetra Tech Job No. 09TEC104.CLR

02

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	April 28, 2009 10:30 am
Contractor:	Spray Systems	Work Area:	B116/2nd Floor RE-TEST NO. 1

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Rick Liddle (Print Name) _____ (Signature) 4/28/09 (Date)

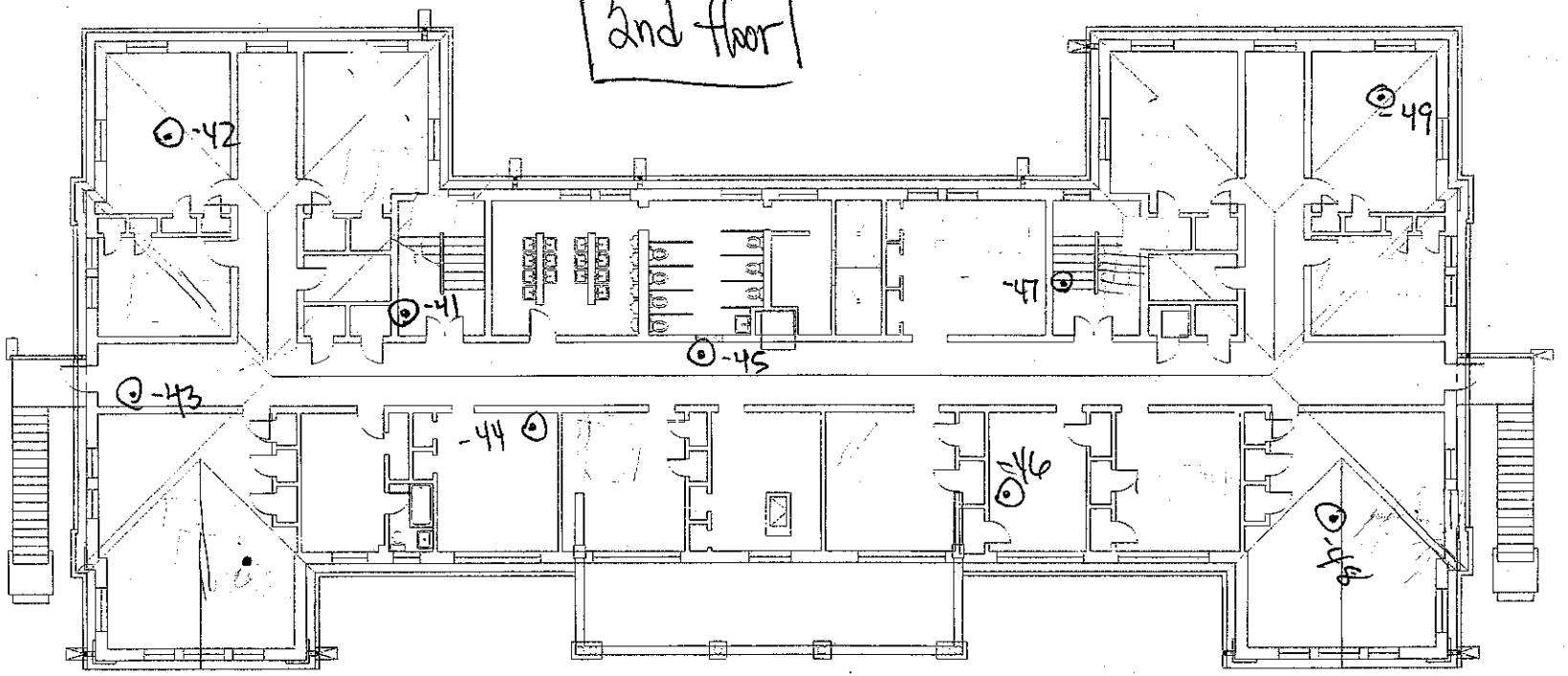
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. All bags of waste have been removed from work area
11. Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Building appears clean - No flaking paint visible. Window sills & floors & walls encapsulated. Looks good.

Tallpines' Representative: Shana Lynne (Print Name) _____ (Signature) 4/28/09 (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Re-Test No. 1

Post-Abatement Wipe Samples for Lead
B116/Boys Dorm / 2nd floor
Tallgrass Job No. 09TEC104.CLR

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104R.CLR | PROJECT NAME: B116 / Fort Apache

CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines

SAMPLER (SIGNATURE): | SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	SAMPLE TYPE & ANALYSIS: AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-31	4/28/09	10:50	Field blank		X				X		(4.5"X4.5")	< Field blank >
B116-32		11:00	Basement N. Room W.		X				X		144 in²	floor
B116-33		11:03	Basement NE Room B7		X				X			
B116-34		11:05	Basement Room B5		X				X			
B116-35		11:09	Basement Central Hall		X				X			
B116-36		11:11	Basement Room B1		X				X			
B116-37		11:15	Basement S. Room landing		X				X			
B116-38		11:18	Basement S. Room E.		X				X			
B-116-39		11:22	Basement S. Staircase		X				X			
B-116-40		11:24	Basement N. Stair landing		X				X			
B-116-41		11:28	2nd floor Stair landing		X				X			
B-116-42		11:31	2nd floor Rm 213		X				X			
B-116-43		11:34	2nd floor N. Hall		X				X			
B-116-44		11:37	2nd floor Rm 210		X				X			
B116-45		11:41	2nd floor Hall Center		X				X			
B116-46		11:45	2nd floor Rm 2-5		X				X			
B116-47		11:50	2nd floor Rm 2-6		X				X			
B116-48		11:54	2nd floor SW Room		X				X			

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	4/28/09	4:30 pm					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
FedEx 8690-3960-2092			Kathy Knowles	4/29/09	10:20

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

1 = 1x

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104R.CLR | PROJECT NAME: B116 Fort Apache

CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines

SAMPLER (SIGNATURE): | SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	SAMPLE TYPE & ANALYSIS: AA/CHIP	AA/WIPE	AA/SOIL	AAMCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	Composite	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-49	4/28/09	12:05	2nd floor SE Rm 2-2		X				X			144 in²	(floor)
B116-50	↓	12:25	Boiler Room Coal Room		X				X			↓	↓
B116-51	↓	12:45	perimeter of building			X				X	X		(composite soil)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	4/28/09	4:30 PM					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
FedEx 8690-3960-2092			Kathy Knowles	4/29/09	16:20

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

2nd re-test

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION			
Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time: 12 pm	May 5, 2009
Contractor:	Spray Systems	Work Area:	B116/Basement RE-TEST NO. 2

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Spray Systems (Not on Site) 5/5/09
(Print Name) (Signature) (Date)

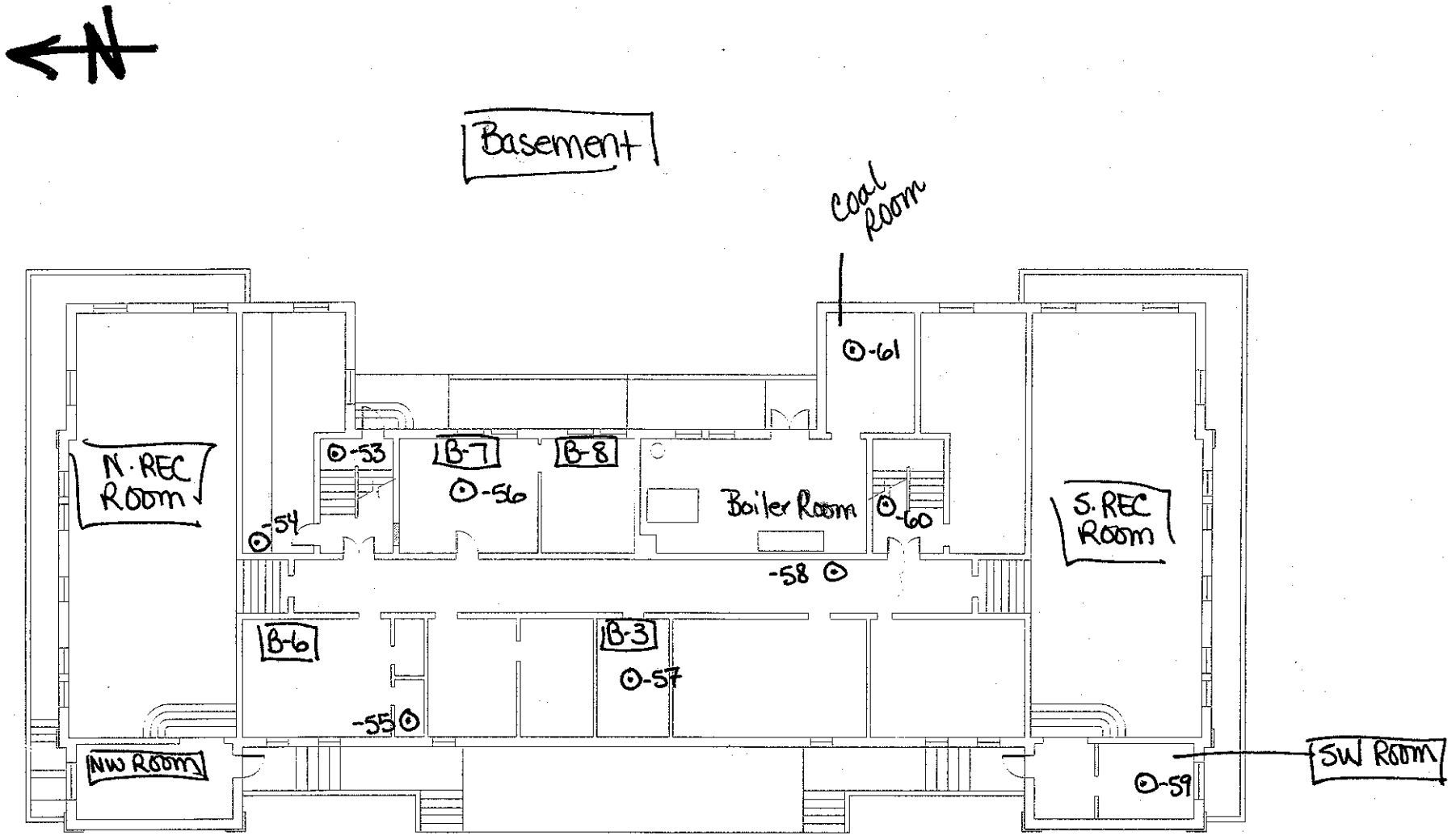
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Basement appears clean. No visible dust on surfaces. Encapsulant applied thoroughly. Nice job. Mold from S. Rec Room SW Rooms has been thoroughly removed. Good job.

Tallpines' Representative: Sharon Lynne 5/5/09
(Print Name) (Signature) (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Key: ⊙-53 Location of Wipe Sample B116-53, -54...

B-6 - Basement Room 6

Re-Test No. 2

Post Abatement Wipe Samples for Lead
B116/Boys Dorm - BASEMENT
Tallpines Job No. 09TEC104.CLR

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

2nd re-test

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09FC104R.CLR
PROJECT NAME: B116 / Fort Apache
CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines
SAMPLER (SIGNATURE):
SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-52	5/5/09		Field blank		X				X		(4.5"x4.5")	Field blank
B116-53			Basement N. Stair landing		X				X		144 in²	floor
B116-54			Basement laundry room		X				X			
B-116-55			Basement NW Closet		X				X			
B116-56			Basement NE center Rm		X				X			
B116-57			Basement W Center Rm		X				X			
B116-58			Basement S. hall		X				X			
B116-59			Basement S. RecRoom SW R.		X				X			
B116-60			Basement S. Stairwell		X				X			
B116-61	↓		Coal Room NE		X				X			

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	5/5/09	4pm					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
Fed Ex 8690-3739-4986				5/6/09	10:32

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

EX

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200903130

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060
FAX: (928) 774-0051

 # Samples: 10 AA **Rec:** 5/6/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104R.CLR

Report Date: 5/7/2009 **Date Analyzed:** 5/7/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

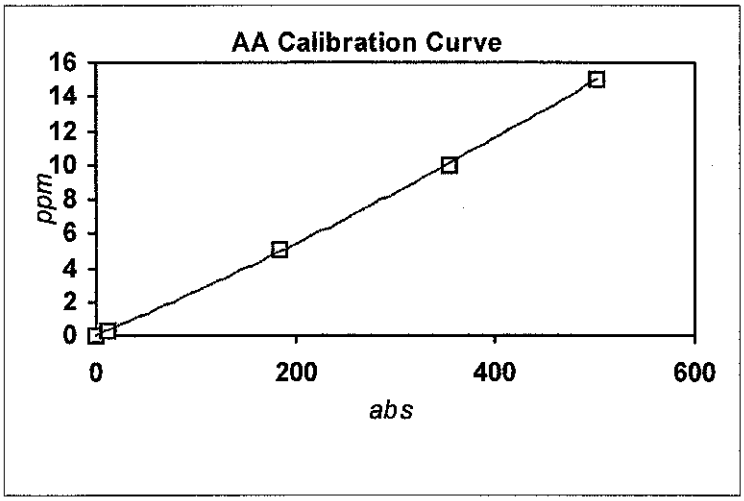
Pb

Run # 6781 *5/7/2009*

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	13
2	5	183
3	10	354
4	15	501

ax2	0.0000094
bx	0.02517037
c	-0.00122635
R2	0.99990527



Analysis Results:

Job Number:	200903130

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-03130-1	B116-52	5/5/2009	acceptable	0.141	0.024	25	1	Pb	<53	<7.5	7.5
2009-03130-2	B116-53	5/5/2009	acceptable	1	11.735	25	1	Pb	290	290	7.5
2009-03130-3	B116-54	5/5/2009	acceptable	1	7.0285	25	1	Pb	180	180	7.5
2009-03130-4	B116-55	5/5/2009	acceptable	1	2.5287	25	1	Pb	63	63	7.5
2009-03130-5	B116-56	5/5/2009	acceptable	1	2.8268	25	1	Pb	71	71	7.5
2009-03130-6	B116-57	5/5/2009	acceptable	1	14.796	25	1	Pb	370	370	7.5
2009-03130-7	B116-58	5/5/2009	acceptable	1	3.2369	25	1	Pb	81	81	7.5
2009-03130-8	B116-59	5/5/2009	acceptable	1	4.4078	25	1	Pb	110	110	7.5
2009-03130-9	B116-60	5/5/2009	acceptable	1	4.3795	25	1	Pb	110	110	7.5
2009-03130-10	B116-61	5/5/2009	acceptable	1	1.3069	25	1	Pb	33	33	7.5

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 07-May-09

Original Print Date: 07-May-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

Gentlemen, attached are the analytical test results for composite soil samples collected at B104 and B116. Soil sample B104-65, collected along the perimeter/dripline of B104, is reported with 900 parts per million (ppm) of total lead. Soil sample B116-51, collected from the perimeter of B116, is reported with 140 ppm of total lead. The HUD clearance standard for bare soil is 2,000 ppm. Congratulations! No further work is warranted on soil, other than removal of LBP fence/posts on north side of B104 (pickup LBP chips, if present). Thanks, Patty

-------- Original Message --------
Subject:FQ 0902941,2942 /WMAT/B116,104/Fort Apache
Date: Fri, 01 May 2009 12:52:26 -0700
From: Karen Grant / KLK <ke2grant@fiberquant.com>
Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aa
Date Rec'd:	04/29/09
Qty Rec'd:	
TAT Req'd:	2-3day

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Soil

JobNumber: 200902941

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060
FAX: (928) 774-0051

 # Samples: 1 AA **Rec:** 4/29/2009 **Method:** Modified SW 846 3050b/7420 AA digestion/analysis of soil

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104.CLR

Report Date: 5/1/2009 **Date Analyzed:** 5/1/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAs

The received samples were analyzed for metals (total) using "Test Methods for Evaluating Solid Waste" (SW 846, December 1996 updates). The extraction/digestion method was SW 3050b. The analytical method is "flame atomic absorption, direct aspiration", SW 7420. Briefly the procedures are as follows. The incoming samples are first dried at 95 degrees C, then passed through 10 and 60 mesh sieves. A sub-sample is weighed to 0.0001 gm into a 50ml centrifuge tube. To the run stream are added the quality assurance samples described below. Six mls of concentrated HNO3 and one ml of 30% H2O2 are added to each container. The tubes are caped and heated for 1 hour at 95 deg. C. After cooling, the contents of the centrifuge tube are brought up to exactly 25 mls, completing the digestion/extraction.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelengths and other instrumental settings are set according to the manufacturer's recommendations, or as otherwise specified in the published method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ppm (ug/gm) for each sample is calculated from the sub-sample weight, extract volume, and extract concentration.

The results from this analysis is generally compared to either a 400 (high contact) or 1200 (non-high contact) ppm concensus standard as lead-containing. The expected coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, samples significantly smaller than 0.2 gm may give results too near the 400 ppm standard to be reliable. Problems in analysis or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in soil (AIHA Lab # 101593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in soil. Results for any other metals, if reported, are not covered by accreditation. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

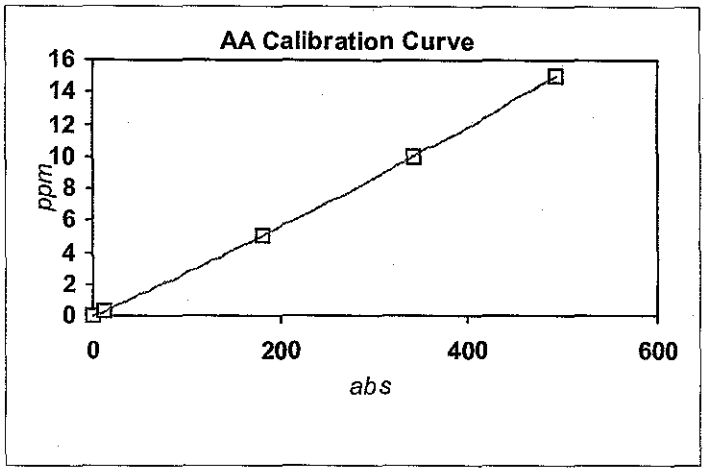
Pb

Run # 6774 ***5/1/2009***

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	13
2	5	181
3	10	342
4	15	493

ax2	0.00000837
bx	0.02637242
c	-0.02487893
R2	0.99998597



Analysis Results:

Job Number:	200902941

AAs

Lab Number	Client Number	Date	Condition	Weight (gm)	ug/ml	ml	Dil	Analyte	ppm	-	RL(ppm)
2009-02941-1	B116-51	4/28/2009	acceptable	0.2145	1.206	25	1	Pb	140	-	35

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 01-May-09

Original Print Date: 01-May-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

3rd re-test

Gentlemen, attached are the analytical test results for the 3rd re-test in the basement portion of B116. All results are reported at <7.5 ug/ft2 versus the HUD clearance level of 40 ug/ft2. The only exception is wipe sample -71, collected on the basement north stair landing, which is reported at 260 ug/ft2. Dave and I just had a discussion regarding the north stair landing, and he was under the impression that it was at basement level rather than the landing 1/2 way up the stairs to the 1st floor. Tallpines' last email regarding B104, dated 5/18/09, mentions that our inspector noted that the north stair landing had not been encapsulated, as discussed. A landing is defined as the platform at either the top or bottom of the stairs. Dave interpreted it as being at the base of the north stairs. I meant it to be the 1/2 way platform between the basement and the 1st floor. If it had been at basement level, it would not have been singled out, it would have been part of the basement floor. Either way, it needs to be recleaned and an additional layer of encapsulant added because the concrete on the landing is quite porous.

Dave wants to wait for the lead re-test results on B104 before any recleaning of the B116 basement north landing is attempted. **Tallpines requests that access to the B116 north stair landing (landing 1/2 way to 1st floor) and stairs to basement remain restricted.** Other than this portion of the north stairwell, the rest of B116 is available for Contractor activities.

Any questions or comments, please call or email. We expect lead re-test results for B104 (recently sanded floors) on either Friday, or next Tuesday. Thanks, Patty

-------- Original Message --------
Subject:FQ 0903472 / WMAT/B116/Fort Apache
Date: Tue, 19 May 2009 10:18:46 -0700
From: Karen Grant / KLK <ke2grant@fiberquant.com>
Reply-To:ke2grant@fiberquant.com
To: Patty Luttrell <tallpines@bmol.com>

Report sent by: Kathy K. ☐ Kathy T. ☐

Method:	aaw
Date Rec'd:	5/18/09
Qty Rec'd:	10
TAT Req'd:	2-3 days

(04)

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

3rd re-test

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time: 12:45 pm	May 14, 2009
Contractor:	Spray Systems	Work Area:	B116/Basement RE-TEST NO. 3

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Spray Systems (Not on Site) 5/14/09
(Print Name) (Signature) (Date)

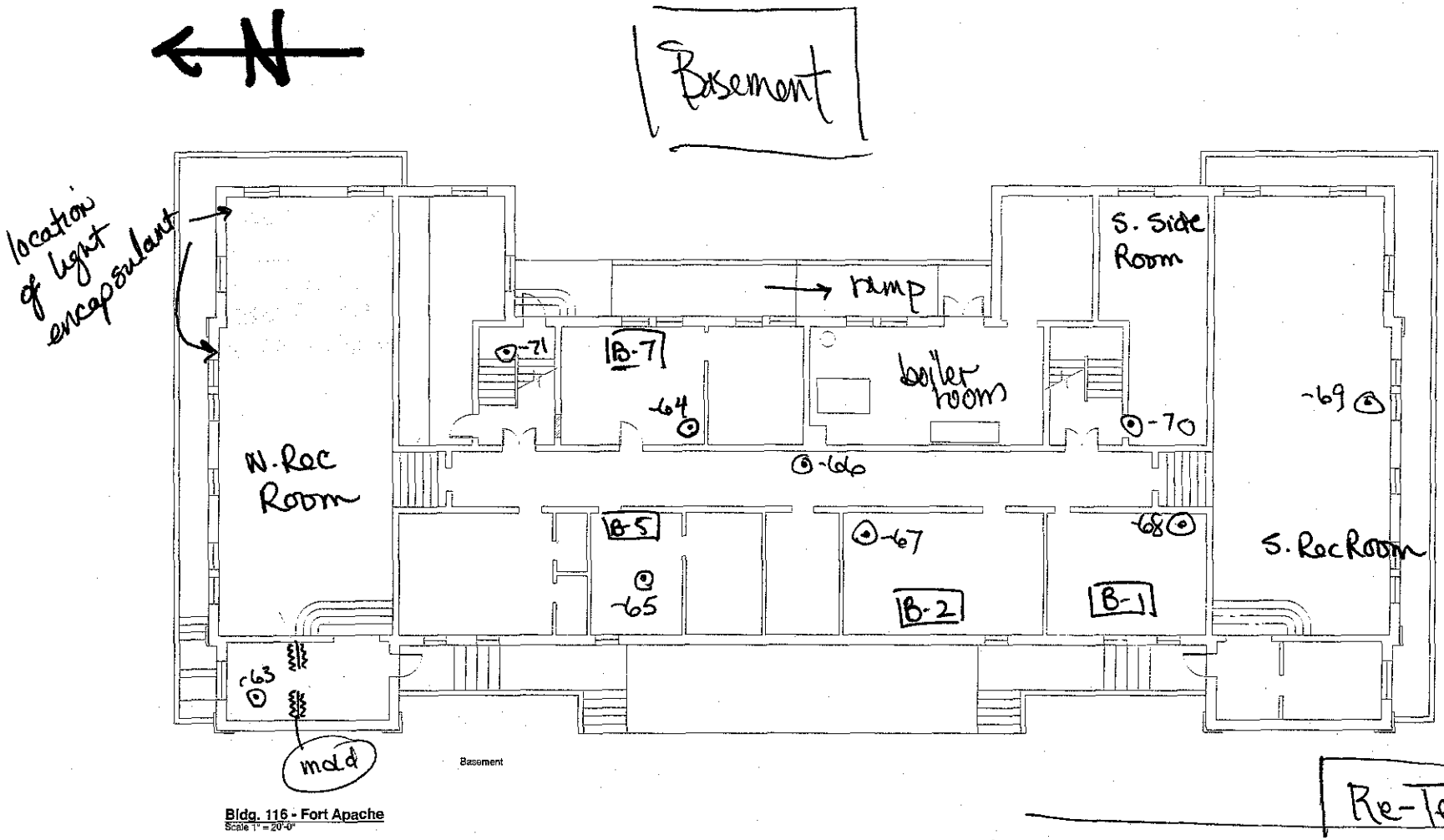
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. ✓ Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. ✓ Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Heavier encapsulant visible across floor in basement. Light area in east portion of N. Rec room. Visible mold on NW recroom room divider wall. Landings and Stairs-no encapsulant.

Tallpines' Representative: Sharon Lynne 5/14/09
(Print Name) (Signature) (Date)



Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Re-Test #3

Post-Abatement Lead Wipes
B116 / Boys Dormitory
Tillmes Job No. 09TEC104.CLR

(04)

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

3rd re-test

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09EC104R.CLR | PROJECT NAME: B116 Fort Apache

CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines

SAMPLER (SIGNATURE): | SAMPLER (PLEASE PRINT): Sharon Lynch

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-62	5/14/09		Field blank		X				X		4.5"x48"	Field blank
B116-63			NW Rec Room		X				X		144 in²	Floors
B116-64			Room B-7 SWC		X				X			
B116-65			Room B-5 Center		X				X			
B116-66			Basement Hall Center		X				X			
B116-67			Room B-2 NEC		X				X			
B116-68			Room B-1 SEC		X				X			
B116-69			S. Rec Room S. Center		X				X			
B116-70			S. Side Room entry		X				X			
B116-71	↓		N. Stairwell landing		X				X		↓	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	5/14/09	4:30pm					
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME	SAMPLE PROCESS TURNAROUND TIME	
FedEx 869037394953			Kathy Knowles	5/18/09	10:23	☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS	

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200903472

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 10 AA **Rec:** 5/18/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104R.CLR

Report Date: 5/19/2009 **Date Analyzed:** 5/19/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

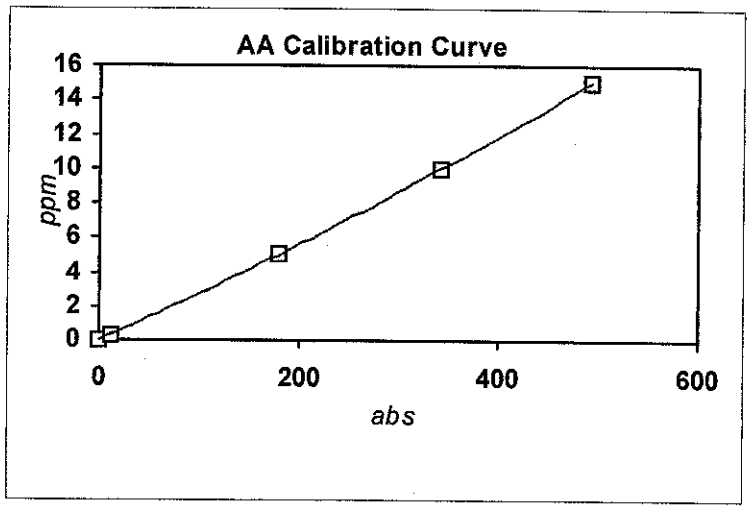
Pb

Run # 6795 ***5/19/2009***

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	12
2	5	179
3	10	343
4	15	492

ax2	0.00000841
bx	0.02634446
c	-0.00526836
R2	0.99999366



Analysis Results:

Job Number:	200903472

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-03472-1	B116-62	5/14/2009	acceptable	0.141	0.0211	25	1	Pb	<53	<7.5	7.5
2009-03472-2	B116-63	5/14/2009	acceptable	1	0.2590	25	1	Pb	<7.5	<7.5	7.5
2009-03472-3	B116-64	5/14/2009	acceptable	1	0.0211	25	1	Pb	<7.5	<7.5	7.5
2009-03472-4	B116-65	5/14/2009	acceptable	1	0.0738	25	1	Pb	<7.5	<7.5	7.5
2009-03472-5	B116-66	5/14/2009	acceptable	1	-0.005	25	1	Pb	<7.5	<7.5	7.5
2009-03472-6	B116-67	5/14/2009	acceptable	1	0.0211	25	1	Pb	<7.5	<7.5	7.5
2009-03472-7	B116-68	5/14/2009	acceptable	1	0.1796	25	1	Pb	<7.5	<7.5	7.5
2009-03472-8	B116-69	5/14/2009	acceptable	1	-0.005	25	1	Pb	<7.5	<7.5	7.5
2009-03472-9	B116-70	5/14/2009	acceptable	1	0.1267	25	1	Pb	<7.5	<7.5	7.5
2009-03472-10	B116-71	5/14/2009	acceptable	1	10.504	25	1	Pb	260	260	7.5

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 19-May-09

Original Print Date: 19-May-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

(4R)

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

4th re-test

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	June 8, 2009 1:10pm
Contractor:	Spray Systems	Work Area:	B116, basement north landing RE-TEST NO. 4

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Spray (Not on Site) 6-8-09
(Print Name) (Signature) (Date)

C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. No visible dust or debris in regulated work area
2. No loose or peeling paint on wall, or ceilings
3. Friction and impact surfaces have been stripped
4. LBP has been spot-removed at areas in need of repair
5. LBP surfaces have been cleaned and encapsulated
6. WARNING LEAD HAZARD tape is demarcating area
7. Work area is to remain inaccessible until clearances
8. No visible paint chips or debris on floors
9. No visible paint chips or debris on stairwells
10. All bags of waste have been removed from work area
11. Haz waste is properly labeled & secured in 55-gallon drums
12. Negative air machines have been turned off a min. of 1 hour
13. Nonhazardous waste has been secured for disposal
14. The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: Does not appear cleaning has been done.
Still No encapsulant on landing.

Tallpines' Representative: Jason Lynn 6/8/09
(Print Name) (Signature) (Date)

4R

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

4th Re-Test

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 07TEC104R.CLR
PROJECT NAME: B116 Fort Apache
CLIENT/COMPANY: White Mountain Apache Tribe C/O Tallpines
SAMPLER (SIGNATURE):
SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-72	6/8/09	1:10	Basement north stair landing (½ way up to 1st floor)		X				X		144 "sq	(floor)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	6/8/09	4:30 pm					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
FedEx 8690-3739-4817			Kathy Knowles	6/9/9	10:14

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

F/X

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200904033

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 1 AA **Rec:** 6/9/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: B116 / Fort Apache **PO Number:** 09TEC104R.CLR

Report Date: 6/12/2009 **Date Analyzed:** 6/12/2009 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

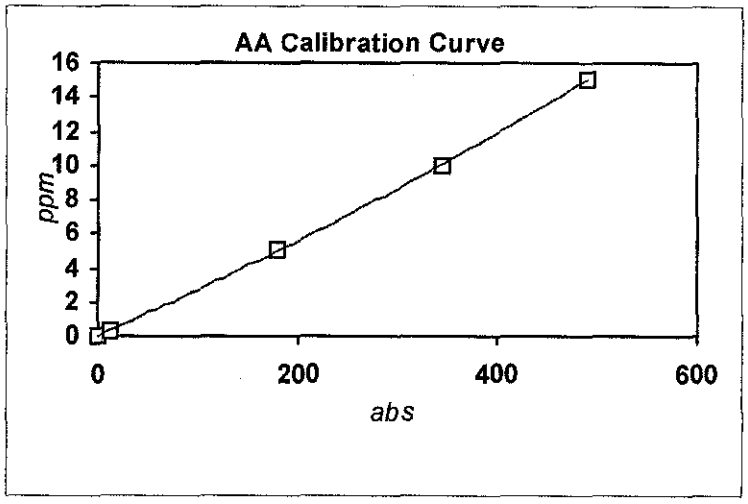
Pb

Run # 6823 ***6/11/2009***

Instrument: M5-2

Standards:	ppm	avg. mAbs.
1	0.3	11
2	5	180
3	10	344
4	15	489

ax2	0.0000101
bx	0.02567835
c	0.0136798
R2	0.99997866



Analysis Results:

Job Number:	200904033	AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-04033-1	B116-72	6/8/2009	acceptable	1	2.2419	25	10	Pb	560	560	7.5

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 12-Jun-09

Original Print Date: 12-Jun-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

5R

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

5th re-test

POST-ABATEMENT LEAD HAZARD CONTROL VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104R.CLR
Project:	Post-Abatement Dust Sampling	Location:	Fort Apache, Arizona
Client Contact:	Dave Kennedy, Project Manager Spray Systems	Date: Time:	June 22, 2009 9:55 am
Contractor:	Spray Systems	Work Area:	B116, basement north landing RE-TEST NO. 5

A) INSPECTION ____ First Inspection ✓ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor's work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including directly beneath the regulated work area, ground level soil and/or concrete sidewalks/surfaces, decontamination unit, 6-mil poly plastic, etc.), and has found no visible dust and/or debris.

Lead Abatement Competent Person: Spray (NO on Site) 6/22/09
(Print Name) (Signature) (Date)

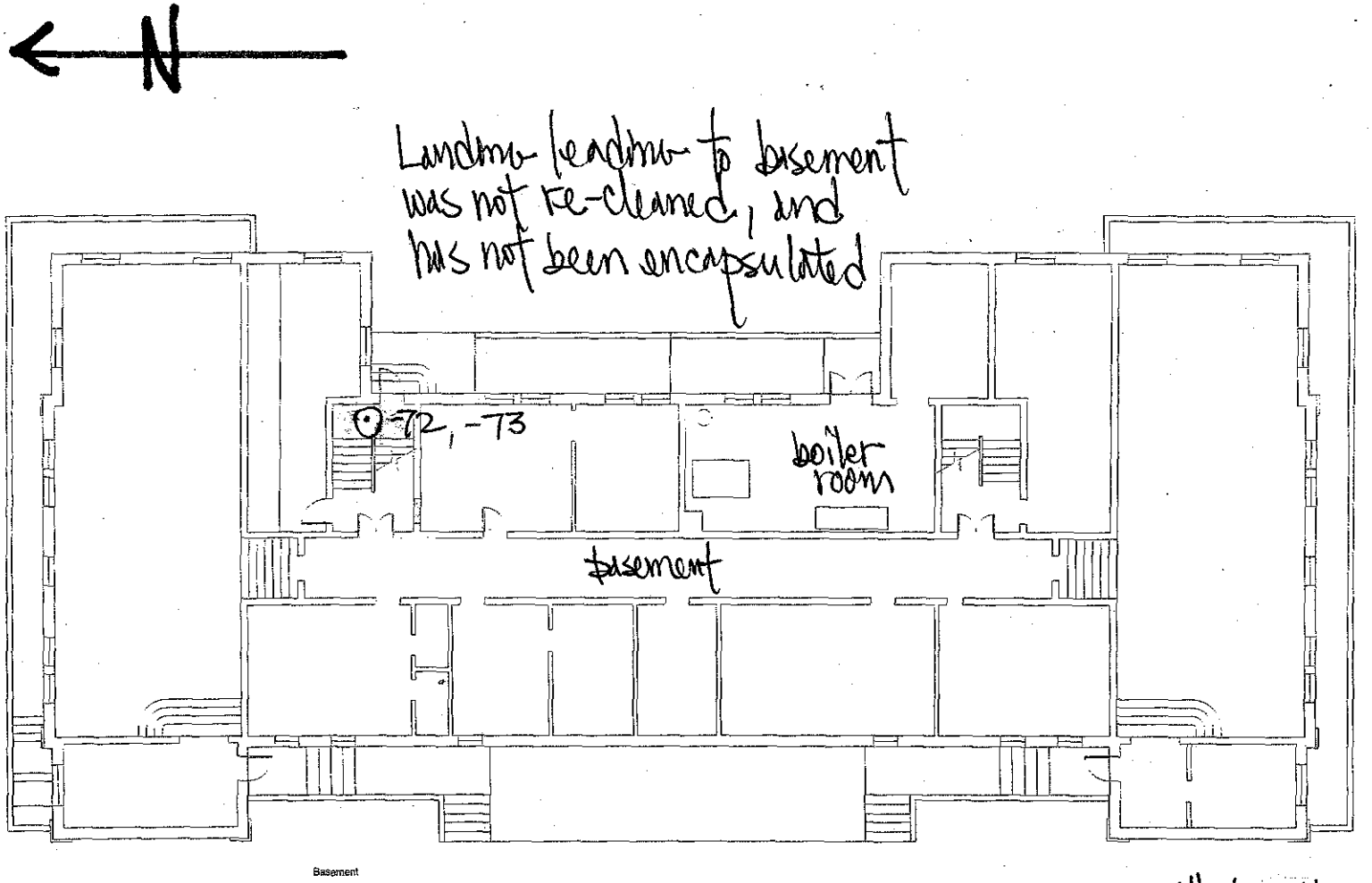
C) TALLPINES' CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible dust or debris in regulated work area
2. ✓ No loose or peeling paint on wall, or ceilings
3. ✓ Friction and impact surfaces have been stripped
4. ✓ LBP has been spot-removed at areas in need of repair
5. ✓ LBP surfaces have been cleaned and encapsulated
6. ✓ WARNING LEAD HAZARD tape is demarcating area
7. ✓ Work area is to remain inaccessible until clearances
8. ✓ No visible paint chips or debris on floors
9. ✓ No visible paint chips or debris on stairwells
10. ✓ All bags of waste have been removed from work area
11. Haz waste is properly labeled & secured in 55-gallon drums
12. ✓ Negative air machines have been turned off a min. of 1 hour
13. Nonhazardous waste has been secured for disposal
14. ✓ The work area is visibly clean & suitable for wipe sampling

D) AUTHORIZATION TO PROCEED WITH WIPE &/OR AIR SAMPLING OF REG. WORK AREA: ✓ YES ___ NO

Comments: White encapsulant paint applied to landing and stair treads. Area taped off at bottom & top of stairs and NE entry door. Looks thoroughly encapsulated and is clean.

Tallpines' Representative: Sharon Lynne 6/22/09
(Print Name) (Signature) (Date)



Basement

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

4th & 5th Re-Tests

B116 / Boy's Dormitory
Tallpines Job 09TEC104R.CLR
Post Abatement Wipe Samples
for Leaded Dust

(2) TALL

(5R)

Originator:
TALLPINES ENVIRONMENTAL CONSULTING CO.
10 WEST DALE AVENUE
FLAGSTAFF, AZ 86001
(928) 774-0060 (FAX) 774-0051

LEAD SAMPLE CHAIN-OF-CUSTODY

5th re-test

Laboratory:
FIBERQUANT ANALYTICAL SERVICES
5025 SOUTH 33rd STREET
PHOENIX, AZ 85040
(602) 276-6139 (FAX) 276-4558

JOB NO.: 09TEC104R-CLR
PROJECT NAME: B116 / Fort Apache
CLIENT/COMPANY: White Mountain Apache Tribe c/o Tallpines
SAMPLER (SIGNATURE):
SAMPLER (PLEASE PRINT): Sharon Lynne

SAMPLE IDENTIFICATION	DATE	TIME	SAMPLE LOCATION	AA/CHIP	AA/WIPE	AA/SOIL	AA/MCE FILTER	AA/FGLASS FILTER	AA by AREA	AA by WEIGHT	AA AREA or AIR VOLUME (L/MIN)	BUILDING COMPONENT / COMMENTS
B116-73	6/22/09	10:01	Basement north stair landing (½ way up to 1st floor)		X				X		144 sq in	Concrete floor

SAMPLE TYPE & ANALYSIS

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	6/22/09	4pm					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME
Fed Ex 8690-3739-4769			Ron Ulis	06/23/09	10:30

SAMPLE PROCESS TURNAROUND TIME
☐ RUSH, 24 HOURS ☒ NORMAL, 2-3 DAYS

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Wipe

JobNumber: 200904513

Client: TALLPINES ENV CONSLTNG CO

10 W DALE AVE

FLAGSTAFF, AZ 86001-0000

Office Phone: (928) 774-0060

FAX: (928) 774-0051

 # Samples: 1 AA **Rec:** 6/23/2009 **Method:** Modified NIOSH 7082 AA digestion/analysis of wipe

Client Job: WMAT/B116/Fort Apache **PO Number:** 09TEC104R.CLR

Report Date: 6/25/2009 **Date Analyzed:** 6/25/2009 **Routing Number:** 5th re-test

Method and Analysis Information: **Fiberquant Internal SOP:** AAw

The received samples were analyzed for Pb (total) by a modified NIOSH 7082 method. Briefly the procedure is as follows. An incoming wipe sample is placed whole into a 150ml beaker. If its container can be seen to contain debris, the debris is rinsed into the beaker as well using 3 M nitric acid. To the run stream of sample beakers are added the quality assurance samples described below. Approximately thirty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes or more when the wipe has been digested, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25-50 mls (depending on wipe material), completing the digestion/extraction. Samples marked as blank (either field or box blank) are analyzed in the same manner as air samples. Sample results are not corrected by blank results.

The sample and quality assurance extractions are then analyzed on a TJA M5 flame atomic absorption spectrometer. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7082 method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ug/sample and ug/area wiped (if known) for each sample is calculated from the extract concentration and area wiped in ft2.

The results from this analysis is generally compared to either EPA regulations or HUD guidelines, which are not identical and range down to 40 ug/ft2 depending on the situation and location of sample. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, smaller sampling areas than 1 ft2 may give results too near the standards to be reliable. Composite samples (up to 5 wipes per sample) are allowed by HUD, but not covered by accreditation, as their analysis has been found to be problematical. Problems in analysis such as these or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by the American Industrial Hygiene Association (AIHA) for environmental lead in wipes (AIHA Lab # 1593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in wipe samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

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Job Analysis Notes:

Calibration Curve:

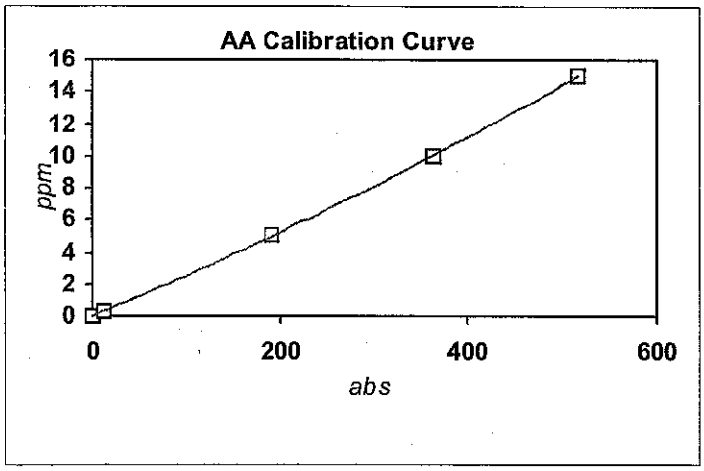
Pb

Run # 6854 ***6/24/2009***

Instrument: M5

Standards:	ppm	avg. mAbs.
1	0.3	13
2	5	192
3	10	364
4	15	517

ax2	0.00000945
bx	0.02411492
c	-0.00348501
R2	0.99999053



Analysis Results:

Job Number:	200904513

AAw

Lab Number	Client Number	Date	Condition	Wp Area(ft2)	ug/ml	ml	Dil	Analyte	ug/ft2	ug/smp	RL(ug/smp)
2009-04513- 1	B116-73	6/22/2009	acceptable	1	0.2143	25	1	Pb	<7.5	<7.5	7.5

Martin Esquer

Analyst: MARTIN A. ESQUER

Printed: 25-Jun-09

Original Print Date: 25-Jun-09

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

APPENDIX C
MOUSE ALLERGENS/RODENTIA and MICROBIAL PAPERWORK

American IAQ Council

hereby certifies that

Patty Rubick Luttrell

has met all the specific standards and qualifications of the re-certification process, including continued professional development, and is hereby re-certified as a

Council-certified Microbial Consultant

CMC

This certificate is valid for 2 years, expiring May 31, 2010.
This certificate remains the property of the
American Indoor Air Quality Council, PO Box 11599, Glendale, AZ 85318

Charles F. Wiles, Executive Director

0606002

Certificate Number

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

Biohazards

POST-ENCAPSULATION WORK AREA VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Cleaning of Biohazards	Location:	B116/Boys Dormitory
Client Contact:	Franklin Quintero, Construction Mgr White Mountain Apache Tribe	Date: Time:	April 15, 2009 10:00 pm
Contractor:	Spray Systems	Work Area:	Attic space

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including walls, floors, ceilings, horizontal surfaces, decontamination unit, 6-mil poly, etc.), and has found no visible mold or water-damaged building materials, debris, or dust.

Remediation Contractor/Supervisor: Rick Liddle (Not on Site) 4/15/09
(Print Name) (Signature) (Date)

C) TALLPINES' INDUSTRIAL HYGIENIST'S CERTIFICATION OF VISUAL INSPECTION

1. ~~No~~ very minor visible contamination on trusses, or sheathing
2. ~~Source(s)~~ of moisture have been corrected
3. ~~Visibly~~ contaminated insulation has been removed
4. ~~No~~ contamination on electrical wires or other systems
5. ~~Containment~~ is labeled with DANGER MICROBIAL tape
6. ~~No~~ visible debris on surfaces covered by 6-mil poly
7. ~~No~~ visible debris inside the underlying building/residence
8. ~~All~~ bags of waste removed from regulated work area
9. ~~All~~ equipment clean, including underside of negative air units
10. ~~Negative~~ pressure differential is -0.025 inches of water
11. ~~Airless~~ spray equipment used for encapsulation with fungicide
12. ~~The~~ work area has been thoroughly encapsulated w/ fungicide

D) AUTHORIZATION TO PROCEED WITH TESTING ACTIVITIES: ✓ YES ___ NO

Comments: Minor amounts of debris visible. Encapsulant appears thorough. Very clean. Bleached prior to encapsulating. Looks very good. Nice job.

Tallpines' Industrial Hygienist: Sharon Lynne 4/15/09
(Print Name) (Signature) (Date)

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ENCAPSULATION WORK AREA VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Cleanup of Biohazards	Location:	B116/Boys Dormitory
Client Contact:	Franklin Quintero, Construction Mgr White Mountain Apache Tribe	Date: Time:	April 15, 2009 11:50 am
Contractor:	Spray Systems	Work Area:	B116/2nd Floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including walls, floors, ceilings, horizontal surfaces, decontamination unit, 6-mil poly, etc.), and has found no visible mold or water-damaged building materials, debris, or dust.

Remediation Contractor/Supervisor: Rick Liddle (Print Name) (Signature) 4/16/09 (Date)

C) TALLPINES' INDUSTRIAL HYGIENIST'S CERTIFICATION OF VISUAL INSPECTION

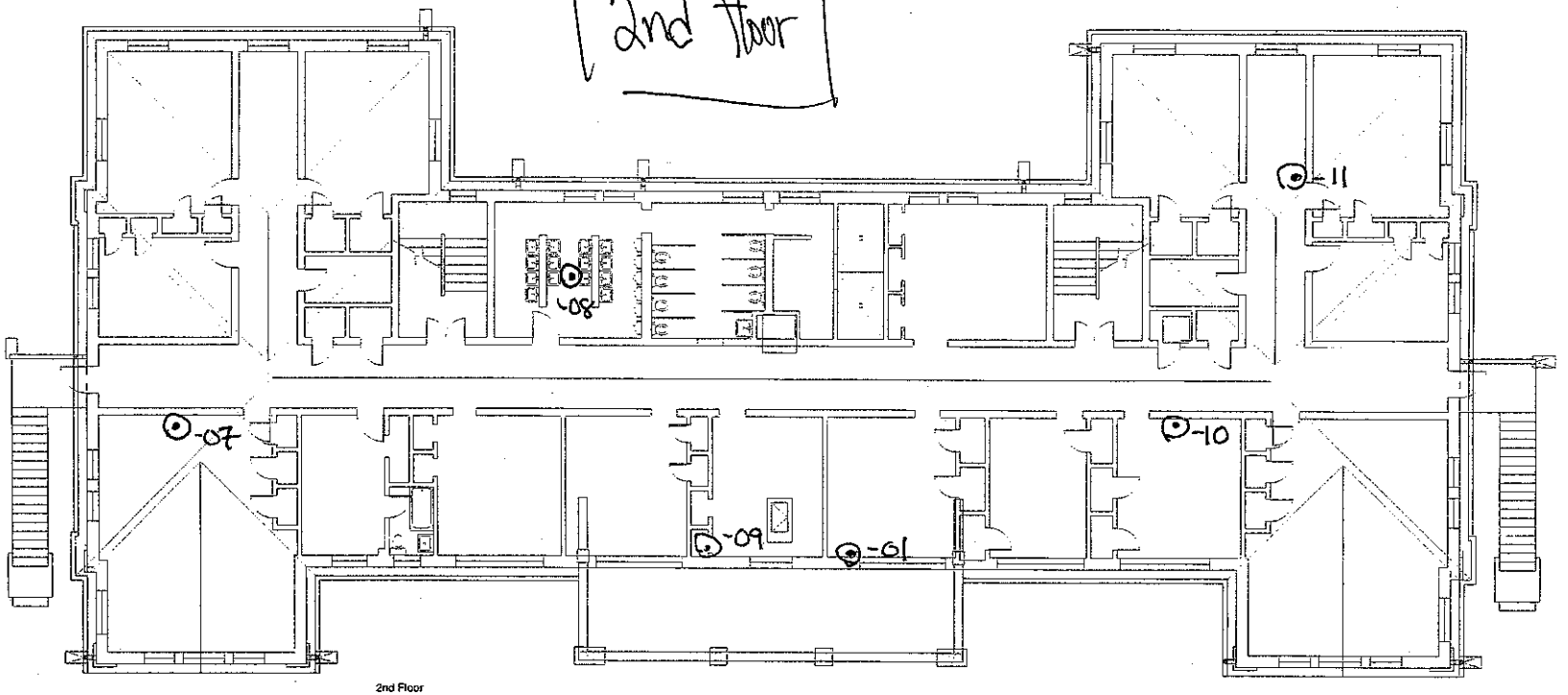
1. ✓ No visible contamination on trusses, or sheathing
2. ✓ Source(s) of moisture have been corrected
3. ✓ Visibly contaminated insulation has been removed
4. ✓ No contamination on electrical wires or other systems
5. ✓ Containment is labeled with DANGER MICROBIAL tape
6. ✓ No visible debris on surfaces covered by 6-mil poly
7. ✓ No visible debris inside the underlying building/residence
8. ✓ All bags of waste removed from regulated work area
9. ✓ All equipment clean, including underside of negative air units
10. ✓ Negative pressure differential is -0.025 inches of water
11. ✓ Airless spray equipment used for encapsulation with fungicide
12. ✓ The work area has been thoroughly encapsulated w/ fungicide

D) AUTHORIZATION TO PROCEED WITH TESTING ACTIVITIES: ✓ YES ___ NO

Comments: Very minor debris visible. Everything looks very clean. Wall cavities at baseboard level that are open/visible are clean. Nice job.

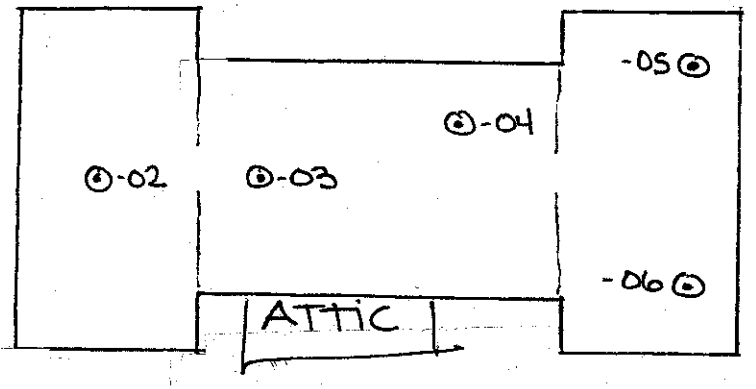
Tallpines' Industrial Hygienist: Sharon Lynne (Print Name) (Signature) 4-16-09 (Date)

2nd floor



2nd Floor

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"



Post-Clearance of Biohazards
B116 / Boy's Dorm - 2nd floor
Tallgrass Job No. 09TEC104.CLR

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ENCAPSULATION WORK AREA VISUAL INSPECTION

Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Cleaning of Biohazards	Location:	B116/Boys Dormitory
Client Contact:	Franklin Quintero, Construction Mgr White Mountain Apache Tribe	Date: Time:	April 16, 2009 11:00 am
Contractor:	Spray Systems	Work Area:	1st Floor

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including walls, floors, ceilings, horizontal surfaces, decontamination unit, 6-mil poly, etc.), and has found no visible mold or water-damaged building materials, debris, or dust.

Remediation Contractor/Supervisor: Rick Liddle (Print Name) _____ (Signature) 4/16/09 (Date)

C) TALLPINES' INDUSTRIAL HYGIENIST'S CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible contamination on trusses, or sheathing
2. ✓ Source(s) of moisture have been corrected
3. ✓ Visibly contaminated insulation has been removed
4. ✓ No contamination on electrical wires or other systems
5. ✓ Containment is labeled with DANGER MICROBIAL tape
6. ✓ No visible debris on surfaces covered by 6-mil poly
7. ✓ No visible debris inside the underlying building/residence
8. ✓ All bags of waste removed from regulated work area
9. ✓ All equipment clean, including underside of negative air units
10. ✓ Negative pressure differential is -0.025 inches of water
11. ✓ Airless spray equipment used for encapsulation with fungicide
12. ✓ The work area has been thoroughly encapsulated w/ fungicide

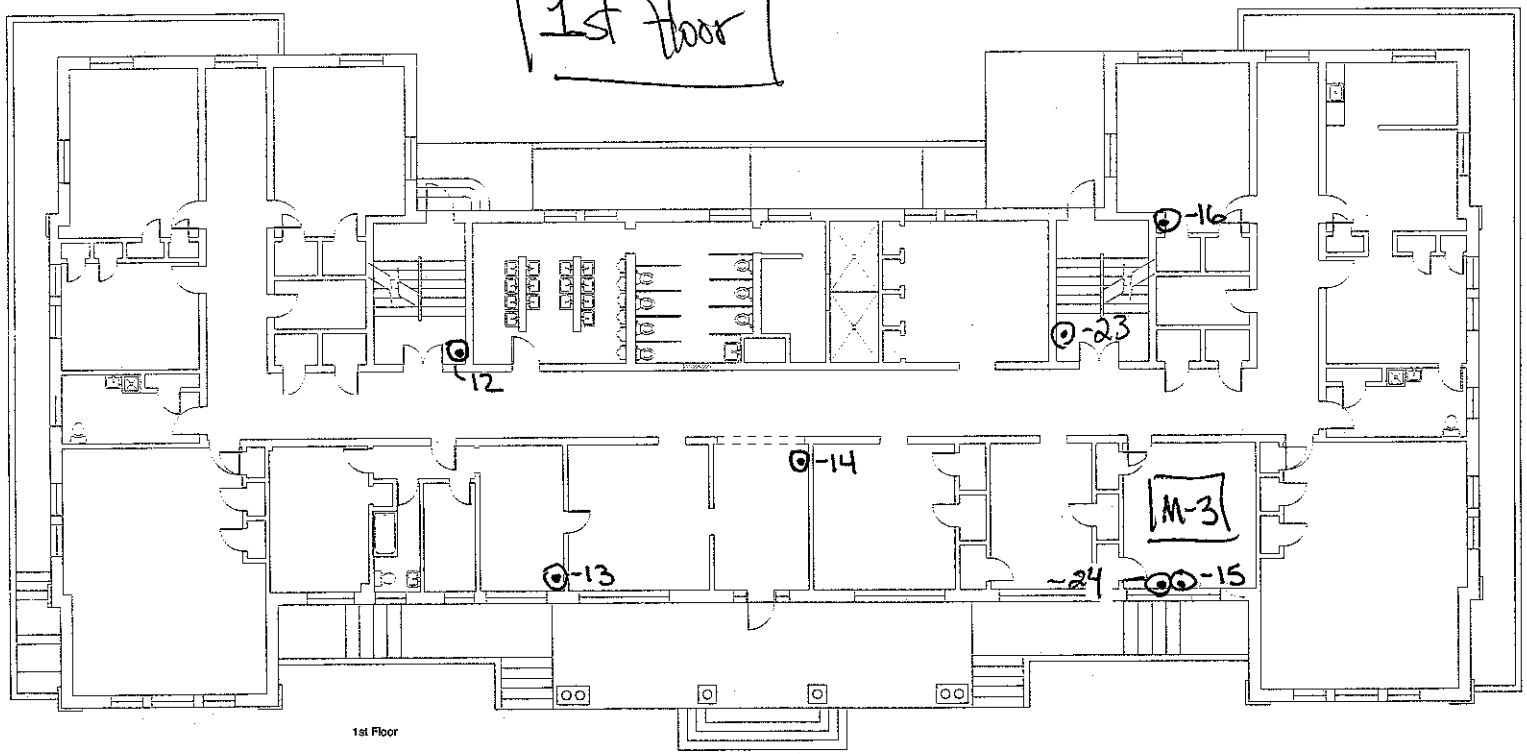
D) AUTHORIZATION TO PROCEED WITH TESTING ACTIVITIES: ✓ YES ___ NO

Comments: Area appears clean. Very minor amounts of debris visible in random corners & wall cavities - Overall very clean. Nice job. 4/28/09 Re-Test M-3 Room & Coal room Debris visible in M-3 wall cavity. Looks clean. Basement has minor debris. Very Clean.

Tallpines' Industrial Hygienist: Sharon Lynne (Print Name) _____ (Signature) 4-16-09 (Date)

N

1st floor



1st Floor

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Cleaning of Biohazards
B116/Boy's Dorms - 1st Floor
Tetra Tech Job No. 09TEC104.CLR

Tallpines Environmental Consulting Co.
10 West Dale Avenue
Flagstaff, Arizona 86001
(928) 774-0060
(FAX) 774-0051

POST-ENCAPSULATION WORK AREA VISUAL INSPECTION			
Client:	White Mountain Apache Tribe	Job No:	09TEC104.CLR
Project:	Post-Cleaning of Biohazards	Location:	B116/Boys Dormitory
Client Contact:	Franklin Quintero, Construction Mgr White Mountain Apache Tribe	Date: Time:	April 16, 2009 11:00 am
Contractor:	Spray Systems	Work Area:	Basement

A) INSPECTION ✓ First Inspection ____ Reinspection

B) CONTRACTOR CERTIFICATION OF VISUAL INSPECTION

In accordance with the Contractor work plan, the Contractor hereby certifies that he/she has visually inspected the Regulated Work Area (all surfaces including walls, floors, ceilings, horizontal surfaces, decontamination unit, 6-mil poly, etc.), and has found no visible mold or water-damaged building materials, debris, or dust.

Remediation Contractor/Supervisor: Rick Liddle _____ 4/16/09
(Print Name) (Signature) (Date)

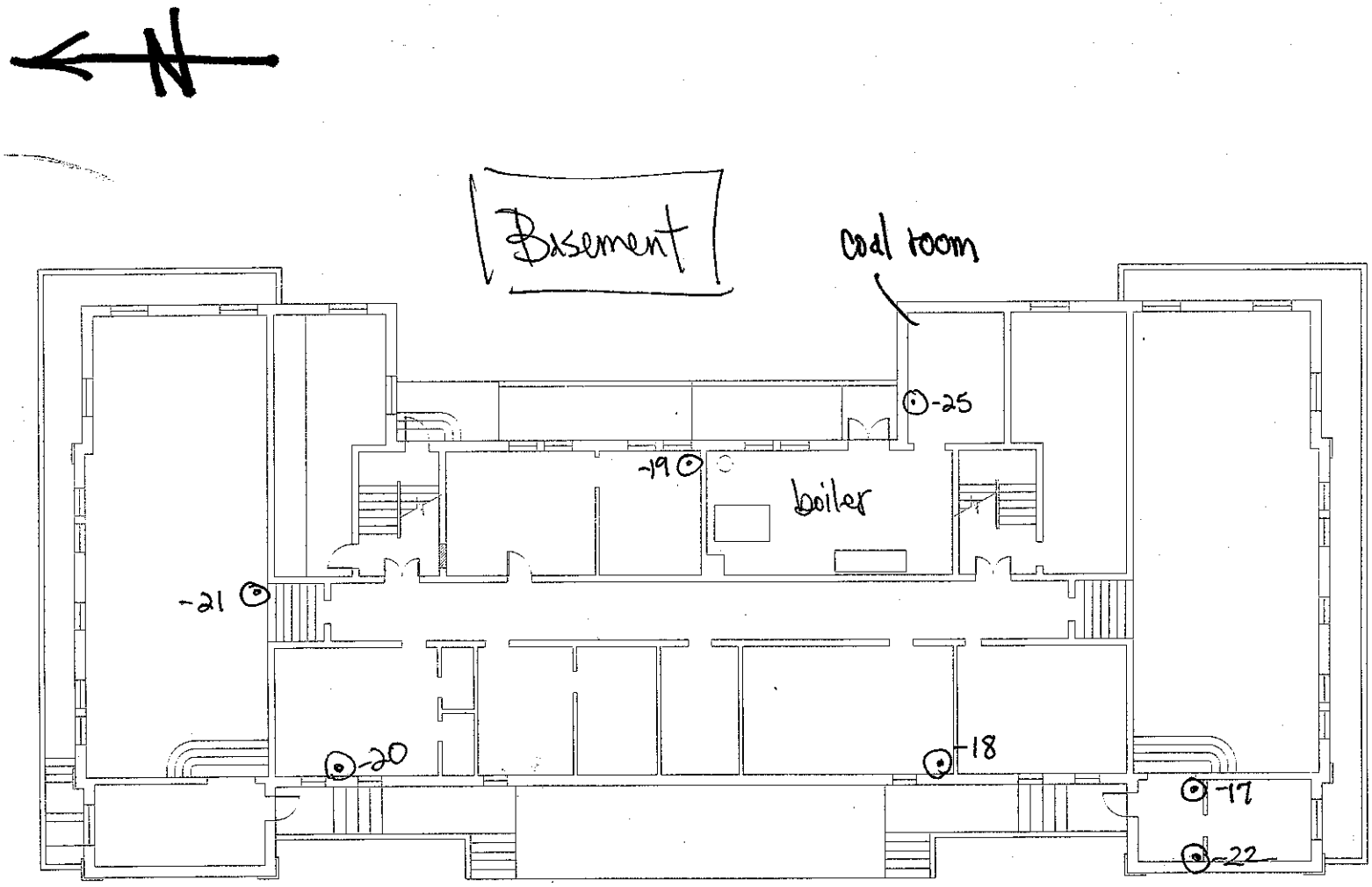
C) TALLPINES' INDUSTRIAL HYGIENIST'S CERTIFICATION OF VISUAL INSPECTION

1. ✓ No visible contamination on trusses, or sheathing
2. ✓ Source(s) of moisture have been corrected
3. ✓ Visibly contaminated insulation has been removed
4. ✓ No contamination on electrical wires or other systems
5. ✓ Containment is labeled with DANGER MICROBIAL tape
6. ✓ No visible debris on surfaces covered by 6-mil poly
7. ✓ No visible debris inside the underlying building/residence
8. ✓ All bags of waste removed from regulated work area
9. ✓ All equipment clean, including underside of negative air units
10. ✓ Negative pressure differential is -0.025 inches of water
11. ✓ Airless spray equipment used for encapsulation with fungicide
12. The work area has been thoroughly encapsulated w/ fungicide

D) AUTHORIZATION TO PROCEED WITH TESTING ACTIVITIES: ✓ YES ____ NO

Comments: Mold visible in S. Rec room SW Corner at stairs. Otherwise, looks very clean w/ only very minor areas of visible debris - Nice job.

Tallpines' Industrial Hygienist: Sharon Lynne _____ 4-16-09
(Print Name) (Signature) (Date)



needs a visual/photo

Bldg. 116 - Fort Apache
Scale 1" = 20'-0"

Post-Cleaning of Biohazards
B116 / Boy's Dorm - Basement
Tolipines Job No. 09TEC104.CLR

(02)

Allergens

TALLPINES' SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Post-Biocleaning Dust Samples
Job No.: 09TEC103.CLR
Location: B116/Boy's Dorm
Date: April 15, 2009 Wednesday

Sample Number	Sample Type	Pump No.	Location (pump and/or bulk samples)	Complaint/ Noncompl & Activity	Time On	Time Off	Total Time (Min)	Initial* Flow Rate (Lpm)	Final* Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L) or (cm^2)
09TEC104-01	Swab	---	2nd floor W. Room Window	C	12:30						50 cm^2
09TEC104-02	CL/CPT	---	attic; east	C	8:35						1 sf
09TEC104-03	CL/CPT	---	attic; east center	C	8:37						2 sf
09TEC104-04	CL/CPT	---	attic; center	C	8:40						2 sf
09TEC104-05	CL/CPT	---	attic; southwest	C	8:42						2 sf
09TEC104-06	CL/CPT	---	attic; northwest	C	8:44						2 sf
09TEC104-07	CL/CPT	---	2nd floor; NW room	C	9:02						2 sf
09TEC104-08	CL/CPT	---	2nd floor; Restroom	C	9:05						2 sf
09TEC104-09	CL/CPT		2nd floor; West central	C	9:08						1 sf
09TEC104-10	CL/CPT		2nd floor; SW	C	9:10						2 sf

Sampled by: Sharon Lynne

Signature:

SAMPLE TYPE: OA = Outdoor ambient air, WC = *Wallchek*, ST = Spore trap, B = Bulk, S = Swab, IMP = Impactor
ACTIVITY: BL = Baseline, BK = Background, A = Area, CL = Clearances NC = Noncomplaint area, C = Complaint area

* Recorded flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

TALLPINES' SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Post-Biocleaning Dust Samples
Job No.: 09TEC103.CLR
Location: B116/Boy's Dorm
Date: April 15, 2009 Wednesday

Sample Number	Sample Type	Pump No.	Location (pump and/or bulk samples)	Complaint/ Noncompl & Activity	Time On	Time Off	Total Time (Min)	Initial* Flow Rate (Lpm)	Final* Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L) or (cm^2)
09TEC104-11	CL/CPT	---	2nd floor; SE hall	C	9:13						2 sf
09TEC104-12	CL/CPT	---	1st floor; N. stairwell	C	11:45						1 sf
09TEC104-13	CL/CPT	-----	1st floor; NW room	C	11:49						1 sf
09TEC104-14	CL/CPT	------	1st floor; W. main entry	C	11:53						1 sf
09TEC104-15	CL/CPT	------	1st floor; SW room	C	11:57						1 sf
09TEC104-16	CL/CPT	------	1st floor; SE room	C	11:59						1 sf
09TEC104-17	CL/CPT	------	Basement; SW	C	9:45						1 sf
09TEC104-18	CL/CPT	------	Basement; SW	C	9:48						1 sf
09TEC104-19	CL/CPT	—	Basement; E Central	C	9:52						1 sf
09TEC104-20	CL/CPT	—	Basement; NW	C	9:55						1 sf

Sampled by: Sharon Lynne

Signature:

SAMPLE TYPE: OA = Outdoor ambient air, WC = *Wallchek*, ST = Spore trap, B = Bulk, S = Swab, IMP = Impactor
ACTIVITY: BL = Baseline, BK = Background, A = Area, CL = Clearances NC = Noncomplaint area, C = Complaint area

* Recorded flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

02C

TALLPINES' SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Post-Biocleaning Dust Samples
Job No.: 09TEC103.CLR
Location: B116/Boy's Dorm
Date: April 15, 2009 Wednesday

Sample Number	Sample Type	Pump No.	Location (pump and/or bulk samples)	Complaint/ Noncompl & Activity	Time On	Time Off	Total Time (Min)	Initial* Flow Rate (Lpm)	Final* Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L) or (cm^2)
09TEC104-21	CL/CPT	---	Basement; North	C	9:59						1 SF
09TEC104-22	Swab	---	Basement; SW	C	12:42						8 cm^2

Sampled by: Sharon Lynne

Signature:

SAMPLE TYPE: OA = Outdoor ambient air, WC = *Wallchek*, ST = Spore trap, B = Bulk, S = Swab, IMP = Impactor
ACTIVITY: BL = Baseline, BK = Background, A = Area, CL = Clearances NC = Noncomplaint area, C = Complaint area

* Recorded flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

EMLab P&K

000533703

www.emlabpk.com www.aerotechpk.com

☐ EMLab P&K
1501 W Knudsen Drive
Phoenix, AZ 85027
800-651-4802

☐ EMLab P&K
1936 Olney Avenue
Cherry Hill, NJ 08003
866-871-1984

☐ Tampa
8742 Benjamin Road, Suite 100
Tampa, FL 33634
813-882-3863

☐ New Orleans
2501 Lexington Avenue,
Kenner, LA 70062
504-469-6812

☐ Billerica
145 Ridgeway Road,
N. Billerica, MA
01862
800-688-8017

Account [redacted] Page 1 of 2

Client

Address TALLPINES ENVIRONMENTAL
10 W. Dale Avenue Flagstaff, AZ 86001

City, S

Contact | Sampler Sharon Lynne

Phone 928-774-0060 | Project Name Fort Apache Bld.116

FAX 928-774-0051 | Project Number 09TEC104.CLR

P.O. Number | Fax Results (Y) N

E-mail tallpines@bmol.com | E-mail Results (Y) N

WEATHER

		Fog	Rain	Snow	Wind	Clear
R/H 20%	None	✓	✓	✓		
	Light					
Temp 50°F	Moderate				✓	
	Heavy					

Sample Type Codes

A - Air B - Bulk (D - Dust) (S - Swab) T - Tape W - Water WC - WallChek Other

Analyses Requested

S-001; fungal ☐ Rush
CC-011; mouse ☐ Rush

Sample Information

#	Sample Identification	Date	Type	S-001; fungal	CC-011; mouse	Area/Volume
1	09TEC104-01; 2nd floor W. Room window	4/16/09	S	X		50 cm^2
2	09TEC104-02; East Attic		D		X	1 sf
3	09TEC104-03; East Center Attic		D		X	2 sf
4	09TEC104-04; Central Attic		D		X	2 sf
5	09TEC104-05; Southwest attic		D		X	2 sf
6	09TEC104-06; Northwest attic		D		X	2 sf
7	09TEC104-07; 2nd floor - NW Room		D		X	2 sf
8	09TEC104-08; 2nd floor - Restroom		D		X	2 sf
9	09TEC104-09; 2nd floor - west Center		D		X	1 sf
10	09TEC104-10; 2nd floor - SW		D		X	2 sf
11	09TEC104-11; 2nd floor - SE hall	↓	D		X	2 sf

Instructions/Special Requirements:

Fed Ex: 8621 7669 4898

On Account (*must have preapproved credit*)

Check Enclosed

Credit Card Payment - (*please circle one*) VISA MC AMEX Discover

Credit Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By
4/17/09	2pm	[signature]	
4/20/09	1000	[signature]	[signature]

COC, P1 OF 1, REVISION 09, 080107 VPOAG

(02)

EMLab P&K

000533703

www.emlabpk.com www.aerotechpk.com

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1501 W Knudsen Drive
Phoenix, AZ 85027
800-651-4802

☐ EMLab P&K
1936 Olney Avenue
Cherry Hill, NJ 08003
866-871-1984

☐ Tampa
6712 Benjamin Road, Suite 100
Tampa, FL 33634
813-882-3083

☐ New Orleans
2501 Lexington Avenue,
Kenner, LA 70062
504-469-6812

☐ Billerica
145 Rangeway Road,
N. Billerica, MA 01862
800-653-6011

Account [redacted] Page 2 of 2

Client [redacted]

Address [redacted] TALLPINES ENVIRONMENTAL

City, S 10 W. Dale Avenue Flagstaff, AZ 86001

WEATHER

LEVEL	Fog	Rain	Snow	Wind	Cloud
None	✓	✓	✓		
Light				✓	
Moderate					
Heavy					

R/H 20% Temp 50°

Sample Type Codes

A - Air B - Bulk (D) - Dust (S) - Swab T - Tape W - Water WC - WallChek Other

Contact | Sampler Sharon Lynne

Phone 928-774-0060 | Project Name Fort Apache Bld 116

FAX 928-774-0051 | Project Number 09TEC104.CLR

P.O. Number | Fax Results (Y) N

E-mail tallpines@hmol.com | E-mail Results (Y) N

Analyses Requested

CC-D11: mouse ☐ Rush*; S-D01: fungal ☐ Rush*

Sample Information

#	Sample Identification	Date	Type	CC-D11: mouse	S-D01: fungal							(Area) Volume
12	09TEC104-12; 1st floor N. Stairwell	4/16/09	D	⊗								1 sf
13	09TEC104-13; 1st floor NW room		D	⊗								1 sf
14	09TEC104-14; 1st floor W. main entry		D	⊗								1 sf
15	09TEC104-15; 1st floor - Room M-3 (pt-1)		D	⊗								1 sf
16	09TEC104-16; 1st floor SE room		D	⊗								1 sf
17	09TEC104-17; SW Basement		D	⊗								1 sf
18	09TEC104-18; SW Basement		D	⊗								1 sf
19	09TEC104-19; E. Central Basement		D	⊗								1 sf
20	09TEC104-20; NW Basement		D	⊗								1 sf
21	09TEC104-21; N. Basement		D	⊗								1 sf
22	09TEC104-22; SW Basement	↓	S		⊗							50 cm²

Instructions/Special Requirements:

Fed EX: 862176694898

On Account (*must have preapproved credit*)
Check Enclosed
Credit Card Payment - (*please circle one*) VISA MC AMEX Discover
Credit Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By
4/17/09	2pm	[signature]	
4/20/09	1000	[signature]	[signature]

PAGE 1 OF 1, REVISION 06, 9/01/07 VPOAB

EMLab P&K

Report for:

Patty Luttrell
Tallpines Environmental
10 W. Dale Avenue
Flagstaff, AZ 86001

Regarding: Project: Fort Apache Bld-116; 09TEC104.CLR
EML ID: 533703

Approved by:

Christine Meyer

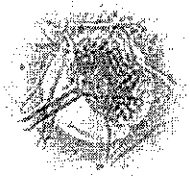
Lab Director
Christine Meyer

Dates of Analysis:
Allergen-ELISA individual: 04-24-2009
Quantitative spore count direct exam: 04-21-2009

Project SOPs: Allergen-ELISA individual (100253), Quantitative spore count direct exam (I100006)

Document Number: 200091 - Revision Number: 5

Allergens



Allergen-ELISA individual

Allergen testing is a quantitative analysis for any of the following Allergens: Cat Allergens (Fel d 1), Dog Allergens (Can f 1), Cockroach Allergens (Bla g 1 and Bla g 2), Dust Mite Allergens (Der p 1, Der f 1), Mouse Allergens (Mus m 1), Rat Allergens (Rat n 1), in household dust. An allergen screen service for Cat, Dog, Dust Mite and Cockroach Allergens is available at a special discount price. More details...

Allergen-ELISA screen

Quantitative Enzyme-Linked ImmunoSorbent Assay (ELISA) analysis for a combination of Cat, Dog, Dust Mite and Cockroach allergens at a special discount price. Restricted to the following five allergens: Der p1, Der f1, Can f1, Fel d1, and Bla g2 More details...

Environmental Microbiology Laboratory, Inc.
1150 Bayhill Drive, Suite 100, San Bruno, CA 94066
(650) 829-5800 Fax (650) 829-5852 www.emlab.com

Client: Environmental Microbiology Laboratory
C/O: Mr. David Gallup
Re: LabServe; Demo

Date of Sampling: 08-15-2005
Date of Receipt: 08-15-2005
Date of Report: 08-16-2005

Reporting Terms

Coefficient of Variation
The Coefficient of Variation (CV), or Relative Standard Deviation, is a relative measure of the magnitude of variability about a mean. The CV values for each allergen are reported in "±" format beside the calculated Sample Result. The data used to calculate the CV are derived from routine analysis of allergen standards of known concentration. The CV values tend to increase as the concentration of allergen increases.
The CV is an indication of the intrinsic variability within the analysis methodology and should be used to understand that reported Sample Results are not absolute values, but indicators of the general range in which a reported allergen level lies.

Threshold Limit Value
Threshold limits have been adopted from "Field Guide for the Determination of Biological Contaminants in Environmental Samples", Dillon, H. Kenneth, ed., et al. American Industrial Hygiene Association Biosafety Committee, Virginia. 1996. For further information refer to the sections "Interpretive Guidelines" and "Information on various Allergens".

Detection Limit
Detection limit refers to the minimum allergen level that could have been detected using the most current ELISA methodology and the available reagents.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					2: 09TEC104-02; East Attic		
Sample Type					Dust sample		
Measurement					0.046 gram		
Lab ID-Version‡:					2365009-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	0.04 ± 0.005	Not Applicable	mcg/gram

Comments:

Location:					3: 09TEC104-03; East Center Attic		
Sample Type					Dust sample		
Measurement					1 sample		
Lab ID-Version‡:					2365010-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.001	-	-	-	< 0.001	Not Applicable	mcg/sample

Comments: Total sample weight was less than 0.03g. Analysis of insufficient dust is not recommended. Results are reported per sample.

Location:					4: 09TEC104-04; Central Attic		
Sample Type					Dust sample		
Measurement					0.096 gram		
Lab ID-Version‡:					2365011-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					5: 09TEC104-05; Southwest Attic		
Sample Type					Dust sample		
Measurement					0.045 gram		
Lab ID-Version‡:					2365012-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

Location:					6: 09TEC104-06; Northwest Attic		
Sample Type					Dust sample		
Measurement					0.059 gram		
Lab ID-Version‡:					2365013-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

Location:					7: 09TEC104-07; 2nd Floor-NW Room		
Sample Type					Dust sample		
Measurement					1 sample		
Lab ID-Version‡:					2365014-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.001	-	-	-	< 0.001	Not Applicable	mcg/sample

Comments: Total sample weight was less than 0.03g. Analysis of insufficient dust is not recommended. Results are reported per sample.

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
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(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					8: 09TEC104-08; 2nd Floor-Restroom		
Sample Type					Dust sample		
Measurement					1 sample		
Lab ID-Version‡:					2365015-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.001	-	-	-	<0.001	Not Applicable	mcg/sample

Comments: Total sample weight was less than 0.03g. Analysis of insufficient dust is not recommended. Results are reported per sample.

Location:					9: 09TEC104-09; 2nd Floor-West Center		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365016-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

Location:					10: 09TEC104-10; 2nd Floor-SW		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365017-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
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(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					11: 09TEC104-11; 2nd Floor-SE Hall		
Sample Type					Dust sample		
Measurement					0.06 gram		
Lab ID-Version‡:					2365018-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

Location:					12: 09TEC104-12; 1st Floor N. Stairwell		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365019-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

Location:					13: 09TEC104-13; 1st Floor NW Room		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365020-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
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(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					17: 09TEC104-17; SW Basement		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365024-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

Location:					18: 09TEC104-18: SW Basement		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365025-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

Location:					19: 09TEC104-19; E. Central Basement		
Sample Type					Dust sample		
Measurement					0.1 gram		
Lab ID-Version‡:					2365026-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
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(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					20: 09TEC104-20; NW Basement		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365027-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

Location:					21: 09TEC104-21; N. Basement		
Sample Type					Dust sample		
Measurement					0.1 gram		
Lab ID-Version‡:					2365028-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	< 0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-24-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					14: 09TEC104-14; 1st Floor W. Main Entry		
Sample Type					Dust sample		
Measurement					0.1 gram		
Lab ID-Version‡:					2365021-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	0.33 ± 0.045	Not Applicable	mcg/gram

Comments:

Location:					15: 09TEC104-15; 1st Floor SW Room		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365022-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	1.83 ± 0.25	Not Applicable	mcg/gram

Comments:

Location:					16: 09TEC104-16; 1st Floor SE Room		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2365023-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	0.49 ± 0.066	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

Gentlemen, attached are the allergen test results for re-test No. 2 conducted at B116. The 2 re-test samples, collected inside the 1st floor room M-3 and the basement coal room, are both reported below the mouse allergen threshold value of 1.6 mcg/gram. Based on the visual inspection and analytical test results, Tallpines authorizes release of 1st floor room M-3. **Access to the basement, north stairwell, and basement coal room are still restricted** until Tallpines can conduct additional testing for leaded dust. This wipe sampling is to be conducted tomorrow with results expected on Friday afternoon unless Spray wants to rush the testing with results on Wednesday afternoon (10 samples; $250 versus $170; 3 day turn around). Dave, let me know. Sharon will be on-site tomorrow at 11ish.

-------- Original Message --------
Subject: Lab Results: Fort Apache Bldg 116
Date: Mon, 4 May 2009 15:45:13 -0600 (MDT)
From:customerservice@emlabpk.com <customerservice@emlabpk.com>
Reply-To:customerservice@emlabpk.com <customerservice@emlabpk.com>,snast@emlabpk.com <snast@emlabpk.com>
To:tallpines@bmol.com <tallpines@bmol.com>

EMLab P&K

Laboratory report

Attached are laboratory reports for the following project:

Account		**Contact(s)**	
Tallpines Environmental		Patty Luttrell	
EMLab ID	**Project ID**	**Project Description**	**PO Number**
537158	Fort Apache Bldg 116	09TEC104.CLR	
Shipping Address		**Billing Address**	
10 W. Dale Avenue Flagstaff, AZ 86001 USA		10 W. Dale Avenue Flagstaff, AZ 86001 USA	

Below is a link to the EMLab Quality and Customer Care Evaluation survey. Because we value your opinions, we would be very appreciative if you would take the time to complete the survey. Thank you very much for your time and consideration.

Customer Care Evaluation Survey

Did you know that EMLab offers analytical asbestos services? Click here for details.

Please feel free to contact us if you have any questions. You may also check the status of this project online using LabServe, our online laboratory information system: Project status.

EMLab P&K
Phone: (866) 888-6653
Web: www.emlab.com
EMLab P&K drop-off locations: Drop-off location listing
Check your project status online: LabServe
Fungal information: EMLab Fungi List

TALLPINES' SAMPLING DATA SHEET

Client: White Mountain Apache Tribe
Project: Post-Biocleaning Dust Samples
Job No.: 09TEC104R.CLR
Location: B116/Boy's Dormitory
Date: April 28, 2009 Wesday

Sample Number	Sample Type	Pump No.	Location (pump and/or bulk samples)	Complaint/ Noncompl & Activity	Time On	Time Off	Total Time (Min)	Initial* Flow Rate (Lpm)	Final* Flow Rate (Lpm)	Ave. Flow Rate (Lpm)	Vol. (L) or (cm^2)
09TEC104-23	BK/CPT	—	Noncomplaint location; Top of Main floor Stair	NC	11:16	—				—	1sf
09TEC104-24	CLR	—	M-3 Room W. wall floor	C	11:20	—				—	1sf
09TEC104-25	CLR	—	Basement coal room NW wall floor	C	11:25	—				—	1sf

Sampled by: Sharon Lynne

Signature:

SAMPLE TYPE: OA = Outdoor ambient air, WC = *Wallchek*, ST = Spore trap, B = Bulk, S = Swab, IMP = Impactor
ACTIVITY: BL = Baseline, BK = Background, A = Area, CL = Clearances NC = Noncomplaint area, C = Complaint area

* Recorded flow rates represent 10 readings averaged by a Bios DryCal DCL-H primary calibrator

Billy / Fort Apache

AEROTECH / P&K
An Affiliate of Severn Trent Laboratories, Inc.

www.AerotechPK.com

000537158

☐ Aerotech Laboratories, Inc. 1501 W Knudsen Drive Phoenix, AZ 85027 800-651-4802

☐ P&K Microbiology Services, Inc. 1936 Olney Avenue Cherry Hill, NJ 08003 866-871-1984

☐ Tampa 5712 Benjamin Road, Suite 150 Tampa, FL 33634 813-892-3653

☐ New Orleans 2501 Lexington Avenue, Kenner, LA 70062 504-469-8812

☐ 146 Ranaway Road, N. Billerica, MA 01862 800-853-8011

Account Number	2134
Page	1 of 1
Client Name	Tallpines Environmental
Address	10 W. Dale Avenue
City, State, Zip	Flagstaff, AZ 86001
Contact	Patty Luttrell
Sampler	Sharon Lynne
Phone	928-774-0050
Project Name	Fort Apache Bldg 116
FAX	928-774-0051
Project Number	OATEC104.CLR
P.O. Number	
Fax Results	(Y) N
E-mail	tallpines@bmol.com
E-mail Results	(Y) N

WEATHER

RH 20% Temp 60°

LEVEL	Fog	Rain	Snow	Wind	Clear
None	✓	✓	✓		
Light				✓	
Moderate					
Heavy					

Sample Type Codes

A - Air B - Bulk (D - Dust) S - Swab T - Tape W - Water WC - WallChek Other

Analyses Requested

Rush fees apply, please indicate time requirements.

Sample Information

#	Sample Identification	Date	Type	CC-OIL; mouse ☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	☐ Rush	Area/Volume
	OATEC104-23; NonComplaint; top of main floor stairs	4/28/09	D	⊗								1 sf
	OATEC104-24; Room M-3, West floor @ Wall	↓	D	⊗								1 sf
	OATEC104-25; Boiler room Coal room NW floor	↓	D	⊗								1 sf

Fed Ex: 862176694854

Instructions/Special Requirements:

X	On Account (*must have preapproved credit*)
	Check Enclosed
	Credit Card Payment - (*please circle one*) VISA MC AMEX Discover
	Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By
4/29/09	4:30 pm	[signature]	
4/30/09	1005	FEDEX	[signature]

COC, P 1 OF 1, REVISION 07, 052408-VPDAS

EMLab P&K

Report for:

Patty Luttrell
Tailpines Environmental
10 W. Dale Avenue
Flagstaff, AZ 86001

Regarding: Project: Fort Apache Bldg 116; 09TEC104.CLR
EML ID: 537158

Approved by:

Christine Meyer

Lab Director
Christine Meyer

Dates of Analysis:
Allergen-ELISA individual: 05-04-2009

Project SOPs: Allergen-ELISA individual (100253)

This coversheet is included with your report in order to comply with AIHA and ISO accreditation requirements.

For clarity, we report the number of significant digits as calculated; but, due to the nature of this type of biological data, the number of significant digits that is used for interpretation should generally be one or two. All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank corrections of results is not a standard practice. The results relate only to the items tested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

Document Number: 200091 - Revision Number: 5

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bldg 116; 09TEC104.CLR

Date of Sampling: 04-28-2009
Date of Receipt: 04-30-2009
Date of Report: 05-04-2009

ALLERGEN REPORT: ELISA METHODOLOGY

Location:					1: 09TEC104-23; Non Complaint; Top Of Main Floor Stairs		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2382005-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

Location:					2: 09TEC104-24; Room M-3, West Floor @ Wall		
Sample Type					Dust sample		
Measurement					0.101 gram		
Lab ID-Version‡:					2382006-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	0.54 ± 0.073	Not Applicable	mcg/gram

Comments:

Location:					3: 09TEC104-25; Boiler Room Coal NW Floor		
Sample Type					Dust sample		
Measurement					0.1 gram		
Lab ID-Version‡:					2382007-1		
Allergen Types	Detection Limit	Threshold Limit Low	Threshold Limit Significant	Threshold Limit High	Sample Result ± CV*	Sample Range	Unit**
Mouse: Mus m1	0.039	-	-	-	<0.039	Not Applicable	mcg/gram

Comments:

* CV = Coefficient of Variation.
** Unit:
mcg/unit of measurement - Micrograms of allergen per unit of measurement.
U/unit of measurement - Units of allergen per unit of measurement.
NOTE: A threshold limit cell without a numeric value indicates that no limit is currently available.
Interpretation is left to the company and/or persons who conducted the field work.
‡A "Version" greater than 1 indicates amended data.

Gentlemen, attached are the analytical test results for 2 swab samples collected inside B116. The remaining vacuumed dust samples were collected to measure rodent allergens and those results are pending. Swab sample -22, collected inside the small room directly inside the SW basement entry of B116, is reported with elevated counts of *Chaetomium, Penicillium/ Aspergillus, and Stachybotrys*. These 4 genera of mold have the potential to produce mycotoxins (stable toxins produced by fungal mold), and are of concern when measured in elevated counts in the indoor environment. This area (mold on wall) needs to be recleaned. The allergen results are expected next week. Patty

-------- Original Message --------
Subject: Lab Results: Fort Apache Bld-116
Date: Tue, 21 Apr 2009 11:50:26 -0600 (MDT)
From:customerservice@emlabpk.com <customerservice@emlabpk.com>
Reply-To:customerservice@emlabpk.com <customerservice@emlabpk.com>,snast@emlabpk.com <snast@emlabpk.com>
To:tallpines@bmol.com <tallpines@bmol.com>

EMLab P&K

Laboratory report

Attached are laboratory reports for the following project:

Account		**Contact(s)**	
Tallpines Environmental		Patty Luttrell	
EMLab ID	**Project ID**	**Project Description**	**PO Number**
533703	Fort Apache Bld-116	09TEC104.CLR	
Shipping Address		**Billing Address**	
10 W. Dale Avenue Flagstaff, AZ 86001 USA		10 W. Dale Avenue Flagstaff, AZ 86001 USA	

Data for the following samples has not yet been released from the laboratory:

Sample ID	Requested Service	Turnaround	Data Available On
2	Allergen-ELISA individual	Standard	04/27/2009*
3	Allergen-ELISA individual	Standard	04/27/2009*
4	Allergen-ELISA individual	Standard	04/27/2009*
5	Allergen-ELISA individual	Standard	04/27/2009*
6	Allergen-ELISA individual	Standard	04/27/2009*
7	Allergen-ELISA individual	Standard	04/27/2009*
8	Allergen-ELISA individual	Standard	04/27/2009*
9	Allergen-ELISA individual	Standard	04/27/2009*
10	Allergen-ELISA individual	Standard	04/27/2009*
11	Allergen-ELISA individual	Standard	04/27/2009*
12	Allergen-ELISA individual	Standard	04/27/2009*
13	Allergen-ELISA individual	Standard	04/27/2009*
14	Allergen-ELISA individual	Standard	04/27/2009*
15	Allergen-ELISA individual	Standard	04/27/2009*
16	Allergen-ELISA individual	Standard	04/27/2009*
17	Allergen-ELISA individual	Standard	04/27/2009*
18	Allergen-ELISA individual	Standard	04/27/2009*
19	Allergen-ELISA individual	Standard	04/27/2009*

(02)

EMLab P&K

000533703

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800-651-4802

☐ EMLab P&K
1936 Olney Avenue
Cherry Hill, NJ 08003
866-871-1984

☐ Tampa
8712 Benjamin Road, Suite 100
Tampa, FL 33634
813-887-3853

☐ New Orleans
2501 Lexington Avenue,
Kenner, LA 70062
504-469-0512

☐ Billerica
148 Ringsway Road,
N. Billerica, MA 01862

Account [redacted] Page 1 of 2

Client

Address TALLPINES ENVIRONMENTAL
10 W. Dale Avenue Flagstaff, AZ 86001

City, S

Contact | Sampler Sharon Lynne

Phone 928-774-0060 | Project Name Fort Apache Bld. 116

FAX 928-774-0051 | Project Number 09TEC104.CLR

P.O. Number | Fax Results (Y) N

E-mail tallpines@bmol.com | E-mail Results (Y) N

WEATHER

		Fog	Rain	Snow	Wind	Clear
RH 20%	None	✓	✓	✓		
Temp 50°F	Light					
	Moderate				✓	
	Heavy					

Sample Type Codes

A - Air B - Bulk (D - Dust) (S - Swab) T - Tape W - Water WC - WallChek Other____

Analyses Requested

S-001: fungal; CC-011: mold (Rush* ☐)

Sample Information

#	Sample Identification	Date	Type	S-001: fungal	CC-011: mold	Area/Volume
1	09TEC104-01; 2nd floor W. Room window	4/16/09	S	X		50 cm²
2	09TEC104-02; East Attic	↓	D		X	1 sf
3	09TEC104-03; East Center Attic		D		X	2 sf
4	09TEC104-04; Central Attic		D		X	2 sf
5	09TEC104-05; Southwest attic		D		X	2 sf
6	09TEC104-06; Northwest attic		D		X	2 sf
7	09TEC104-07; 2nd floor - NW Room		D		X	2 sf
8	09TEC104-08; 2nd floor - Restroom		D		X	2 sf
9	09TEC104-09; 2nd floor - west Center		D		X	1 sf
10	09TEC104-10; 2nd floor - SW		D		X	2 sf
11	09TEC104-11; 2nd floor - SE hall	↓	D		X	2 sf

Instructions/Special Requirements:

Fed Ex: 8621 7669 4898

On Account (*must have preapproved credit*)

Check Enclosed

Credit Card Payment - (*please circle one*) VISA MC AMEX Discover

Credit Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By
4/17/09	2 pm	[signature]	
4/20/09	1000	[signature]	[signature]

COC, P 1 OF 1 REVISION 09, 080107 VFQAS

(02)

EMLab P&K

000533703

www.emlabpk.com www.aerotechpk.com

☐ EMLab P&K
1501 W Knudsen Drive
Phoenix, AZ 85027
800-651-4802

☐ EMLab P&K
1936 Olney Avenue
Cherry Hill, NJ 08003
866-871-1984

☐ Tampa
5712 Benjamin Road, Suite 100
Tampa, FL 33634
813-892-3083

☐ New Orleans
2501 Lexington Avenue,
Kenner, LA 70062
504-469-6612

☐ Billerica
146 Ridgeway Road,
N. Billerica, MA 01862
800-663-8011

Page 2 of 2

Account [redacted]
Client
Address
TALLPINES ENVIRONMENTAL
City, S... 10 W. Dale Avenue Flagstaff, AZ 86001

Contact:
Sampler: Sharon Lynne
Phone: 928-774-0060
Project Name: Fort Apache Bld 116
FAX: 928-774-0051
Project Number: 09TEC104.CLR
P.O. Number:
Fax Results: (Y) N
E-mail: tallpines@hmol.com
E-mail Results: (Y) N

WEATHER

LEVEL	Fog	Rain	Snow	Wind	Clear
None	✓	✓	✓		
Light				✓	
Moderate					
Heavy					

R/H 20%
Temp 50°

Sample Type Codes

A - Air B - Bulk (D) - Dust (S) - Swab T - Tape
W - Water WC - WallChek Other ______

Analyses Requested

Analyses requested: CC-D11: mold SEM; S-D01: fungal

Sample Information

#	Sample Identification	Date	Type	CC-D11: mold SEM	S-D01: fungal	Area/Volume
12	09TEC104-12; 1st floor N. Stairwell	4/16/09	D	⊗		1 sf
13	09TEC104-13; 1st floor NW room		D	⊗		1 sf
14	09TEC104-14; 1st floor W. main entry		D	⊗		1 sf
15	09TEC104-15; 1st floor SW room		D	⊗		1 sf
16	09TEC104-16; 1st floor SE room		D	⊗		1 sf
17	09TEC104-17; SW Basement		D	⊗		1 sf
18	09TEC104-18; SW Basement		D	⊗		1 sf
19	09TEC104-19; E. Central Basement		D	⊗		1 sf
20	09TEC104-20; NW Basement		D	⊗		1 sf
21	09TEC104-21; N. Basement		D	⊗		1 sf
22	09TEC104-22; SW Basement	↓	S		⊗	50 cm²

Instructions/Special Requirements:

Fed Ex: 862176694898

☐ On Account (*must have preapproved credit*)
☐ Check Enclosed
☐ Credit Card Payment - (*please circle one*) VISA MC AMEX Discover
Credit Card Number Expiration Date Signature

Date	Time	Samples Relinquished By	Samples Received By
4/17/09	2pm	[signature]	
4/20/09	1030	[signature]	[signature]

EMLab P&K

Report for:

Patty Luttrell
Tailpines Environmental
10 W. Dale Avenue
Flagstaff, AZ 86001

Regarding: Project: Fort Apache Bld-116; 09TEC104.CLR
EML ID: 533703

Approved by:

Christine Meyer

Lab Director
Christine Meyer

Dates of Analysis:
Quantitative spore count direct exam: 04-21-2009

Project SOPs: Quantitative spore count direct exam (I100006)

This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA and EMLAP accredited laboratory. The data generated in this report are based on the samples and accompanying information provided and represent concentrations at a point in time under the conditions sampled. Results can vary with site conditions. EMLab P&K employees did not collect samples for this project, may provide only limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

EMLab P&K is staffed with highly trained professionals, including PhD's, chemists, and registered microbiologists with over 40 years of experience. The reliability of test results depends on many factors such as the personnel performing the tests, environmental conditions, selection and validation of test methods, equipment functioning, measurement traceability, as well as the sampling, storage and handling of test items, all of which are a reflection of the laboratories overall quality system.

EMLab P&K has modeled its quality system after ISO 17025, General Requirements for the Competence of Testing and Calibration Laboratories, one of the most stringent sets of standards in the industry, to ensure that its customers receive the high standard of accuracy, reliability, and impartiality that they have come to expect from a leader in the environmental industry. EMLab P&K's adherence to the standards set forth in ISO 17025 has been validated and formally recognized through accreditations granted by an independent outside agency, American Industrial Hygiene Association (AIHA). As an additional measure to demonstrate its competency to perform the analyses it offers to its competency to perform the analyses it offers to its clients, EMLab P&K also participates in a variety of different proficiency testing programs, including the Environmental Microbiology Proficiency Analytical Testing Program (EMPAT) sponsored by the American Industrial Hygiene Association.

As part of its continuous commitment to excellence, EMLab P&K is also inspected, licensed and/or accredited by a number of governmental agencies and independent associations in addition to those already mentioned above. The scope document, accreditation certificates, and proficiency results can all be accessed at www.emlab.com. Below you will find additional information regarding the specific analyses requested for this project.

Comments

The comments identify issues or events that are relevant to your analytical results. A comment includes information about the validity, the source of the data whether calculated, entered or estimated, and the value of an observation. In each case the comments provide significant information vital to the interpretation of the laboratory data.

For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Analytical References

Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.
Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.
Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
Manual of Clinical Microbiology, 7th ed., ASM, 1999.
A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
Bioaerosols: Assessment and Control, ACGIH, 1999.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Tallpines Environmental
C/O: Patty Luttrell
Re: Fort Apache Bld-116; 09TEC104.CLR

Date of Sampling: 04-16-2009
Date of Receipt: 04-20-2009
Date of Report: 04-21-2009

QUANTITATIVE SPORE COUNT REPORT

Location:	→ 1: 09TEC104; 2nd Floor W. Room Window				→ 22: 09TEC104; SW Basement			
Comments (see below)	None				None			
Sample type	Swab sample 01				Swab sample 22			
Lab ID-Version‡:	2365029-1				2365030-1			
Background debris (1-4+)	2+				3+			
Sample size	50 cm2				50 cm2			
Reporting unit	1 cm2				1 cm2			
Detection limit/unit	0.8				0.8			
	Count	Count/sample	Count/unit	%	Count	Count/sample	Count/unit	%
Hyphal fragments	5	380	7.7	n/a	47	210,000	4,200	n/a
§ TOTAL FUNGAL SPORES	14	1,100	22	100	240	1,100,000	21,000	100
Alternaria								
Arthrinium								
Ascospores	12	920	18	85				
Basidiospores								
Bipolaris/Drechslera group								
Botrytis								
Chaetomium					76	340,000	6,800	32
Cladosporium								
Curvularia								
Epicoccum								
Myrothecium								
Nigrospora								
Penicillium/Aspergillus types	2	150	3.1	15	102	460,000	9,200	43
Pithomyces								
Rusts								
Smuts, Periconia, Myxomycetes								
Stachybotrys					60	270,000	5,400	25
Stemphylium								
Torula								
Ulocladium								
Zygomycetes								

Comments:

‡ A "Version" greater than 1 indicates amended data.
§ Total Fungal Spores has been rounded to two significant figures to reflect analytical precision.

Aerotech Laboratories, Inc.

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NOTICE OF REQUIREMENTS FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246 AND 41 CFR PART 60-4)

The following Notice shall be included in, and shall be a part of all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts in excess of $10,000.

The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation for each trade
	19.6 %	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non federally involved construction.
The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is:

State of Arizona

County of Navajo

City of Whiteriver

Back

FORM **CD-512**
(REV 12-04)

U.S. DEPARTMENT OF COMMERCE

CERTIFICATION REGARDING LOBBYING
LOWER TIER COVERED TRANSACTIONS

Applicants should review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 15 CFR Part 28, "New Restrictions on Lobbying."

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan guarantee over $150,000 as defined at 15 CFR Part 28, Sections 28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure Form to Report Lobbying,'' in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.

NAME OF APPLICANT	AWARD NUMBER AND/OR PROJECT NAME
Fort Apache Heritage Foundation	Home of Harmony Project

PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE

SIGNATURE	DATE

OMB Number: 0610-0096
Expiration Date: 11/30/2021

EDA PROJECT SIGN

The Contractor shall supply, erect, and maintain in good condition a project sign according to the specifications set forth below:

EDA SITE SIGN SPECIFICATIONS

Size: 4' x 8' x ¾"

Materials: Exterior grade/MDO plywood (APA rating A-B)

Supports: 4" x 4" x 12' posts with 2" x 4" cross branching

Erection: Posts shall be set a minimum of three feet deep in concrete footings that are at least 12" in diameter.

Paint: Outdoor enamel

Colors: Jet Black, Blue (PMS300), and Gold (PMS7406). Specifically, on white background the following will be placed:

The U. S. Department of Commerce seal in blue, black, and gold;

"EDA" in blue;

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT

ADMINISTRATION" in black;

"In partnership with" in blue;

(Actual name of the) "EDA Grant Recipient" in black;

Lettering: Specific fonts are named below; positioning will be as shown on the attached illustration.

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION" use Bank Gothic Medium - BANK GOTHIC MED

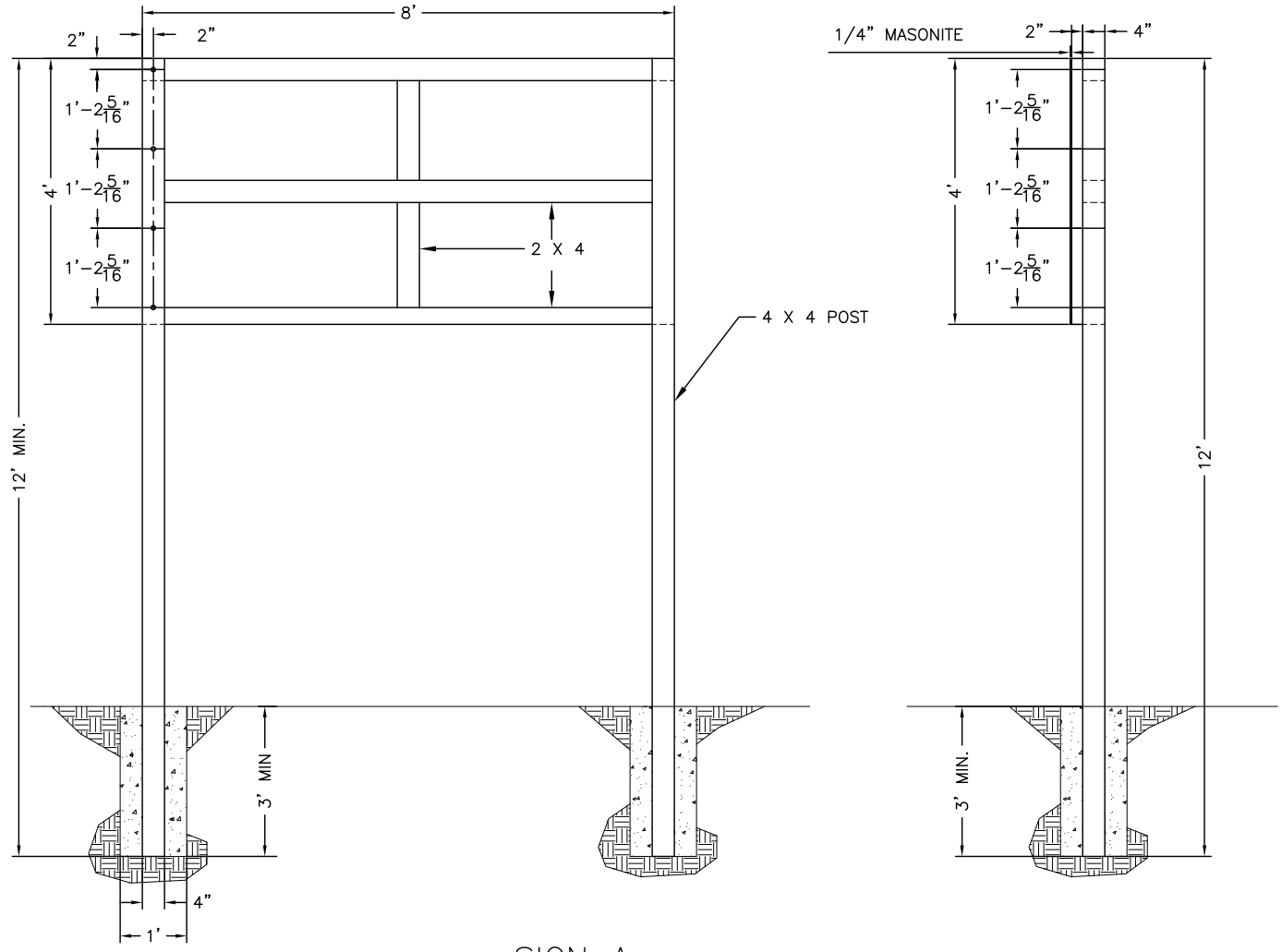
"In partnership with" use Univers™ 55 Oblique - *Univers 55*

(Name of) "EDA Grant Recipient" use Univers™ Extra Black 85 **Univers 85**

Project signs will not be erected on public highway rights-of-way. If any possibility exists for obstruction to traffic line of sight, the location and height of the sign will be coordinated with the agency responsible for highway or street safety in the area.

The EDA Regional Director may permit modifications to these specifications if they conflict with state law or local ordinances.

OMB Number: 0610-0096
Expiration Date: 11/30/2021

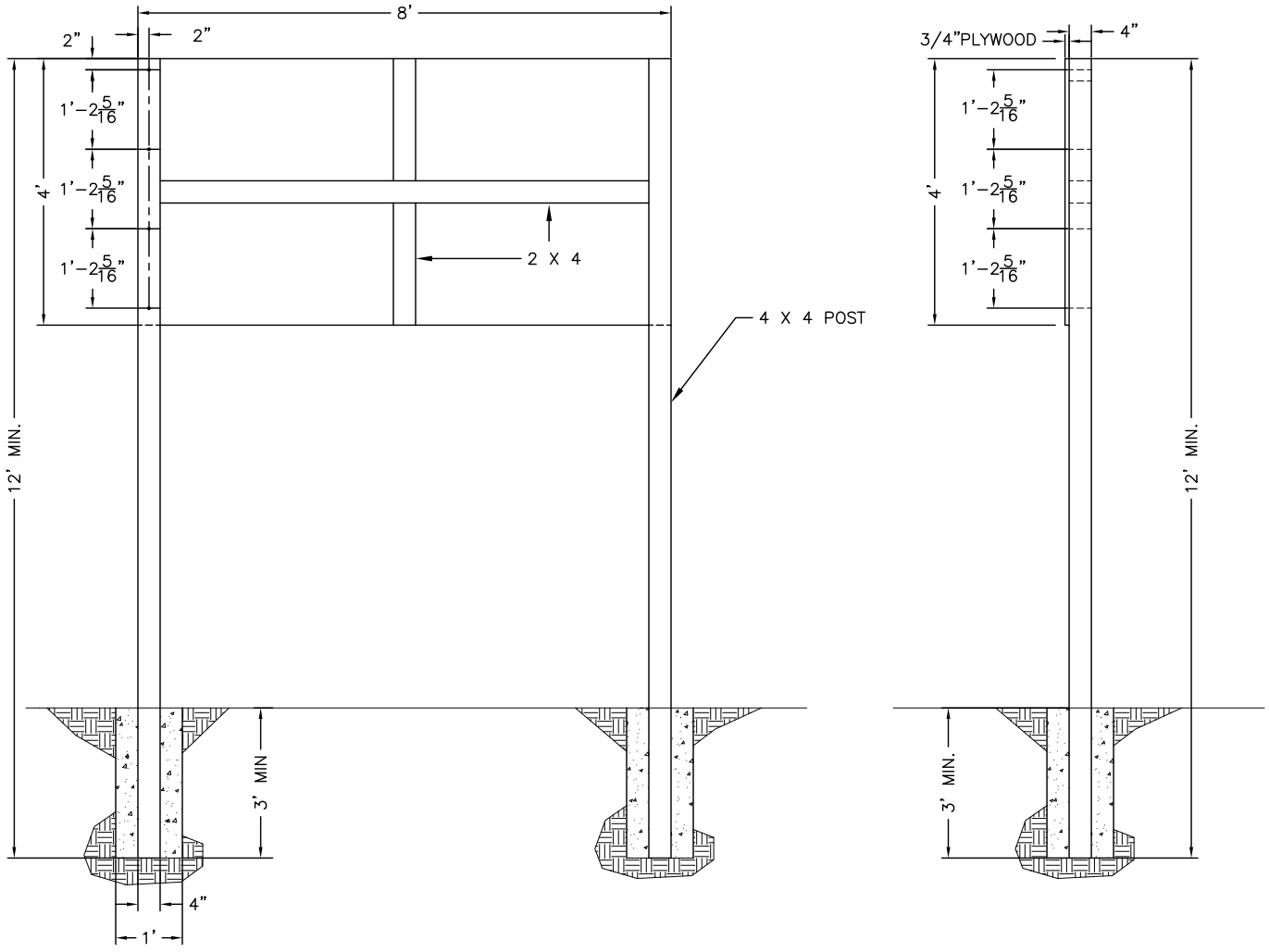


SIGN A
MASONITE SIGN

SCALE: 3/8" = 1'

PROJECT - SIGN A
ECONOMIC DEVELOPMENT ADMINISTRATION

OMB Number: 0610-0096
Expiration Date: 11/30/2021



SIGN B
PLYWOOD SIGN
SCALE: 3/8" = 1'

PROJECT - SIGN B
ECONOMIC DEVELOPMENT ADMINISTRATION

Variations and Usage

There is one approved mark associated with the Investing In America logo. To preserve the integrity of the Investing In America logo mark, make sure to apply them correctly. Altering, distorting, or recreating the 'marks' in any way weakens the power of the image and what it represents. Layout and design of signs and communication materials will vary, so care must be taken when applying the logo mark.

Primary Logo Mark

INVESTING IN AMERICA

Colors

The colors, graphics, and fonts used should conform to graphic standards.

COLOR	CMYK	RGB	HEX	PMS
Blue	83, 48, 0, 48	22 / 68 / 132	#164484	PMS 7687 C
Red	0, 100, 81, 0	255 / 0 / 49	#FF0031	PMS 185 C
White	2, 2, 0, 3	242 / 244 / 248	#F2F4F8	Bright White

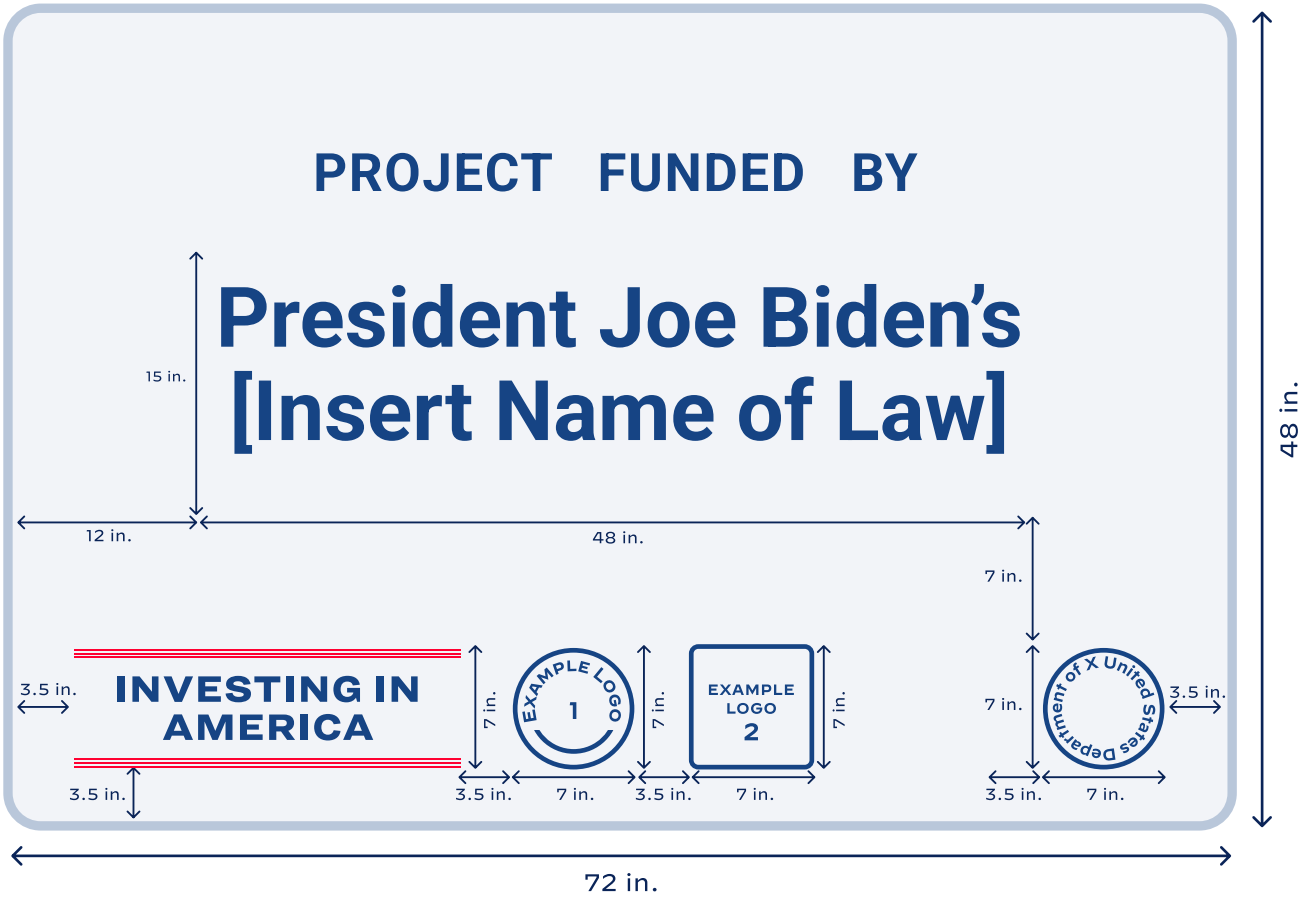
Logos

White background: logo in red and blue

Gray background: logo in red and blue

Blue background: logo in all white

Investing In America General Guidelines for Logo Applications



Sign Colors

4. The American Rescue Plan

White

Gray

Blue

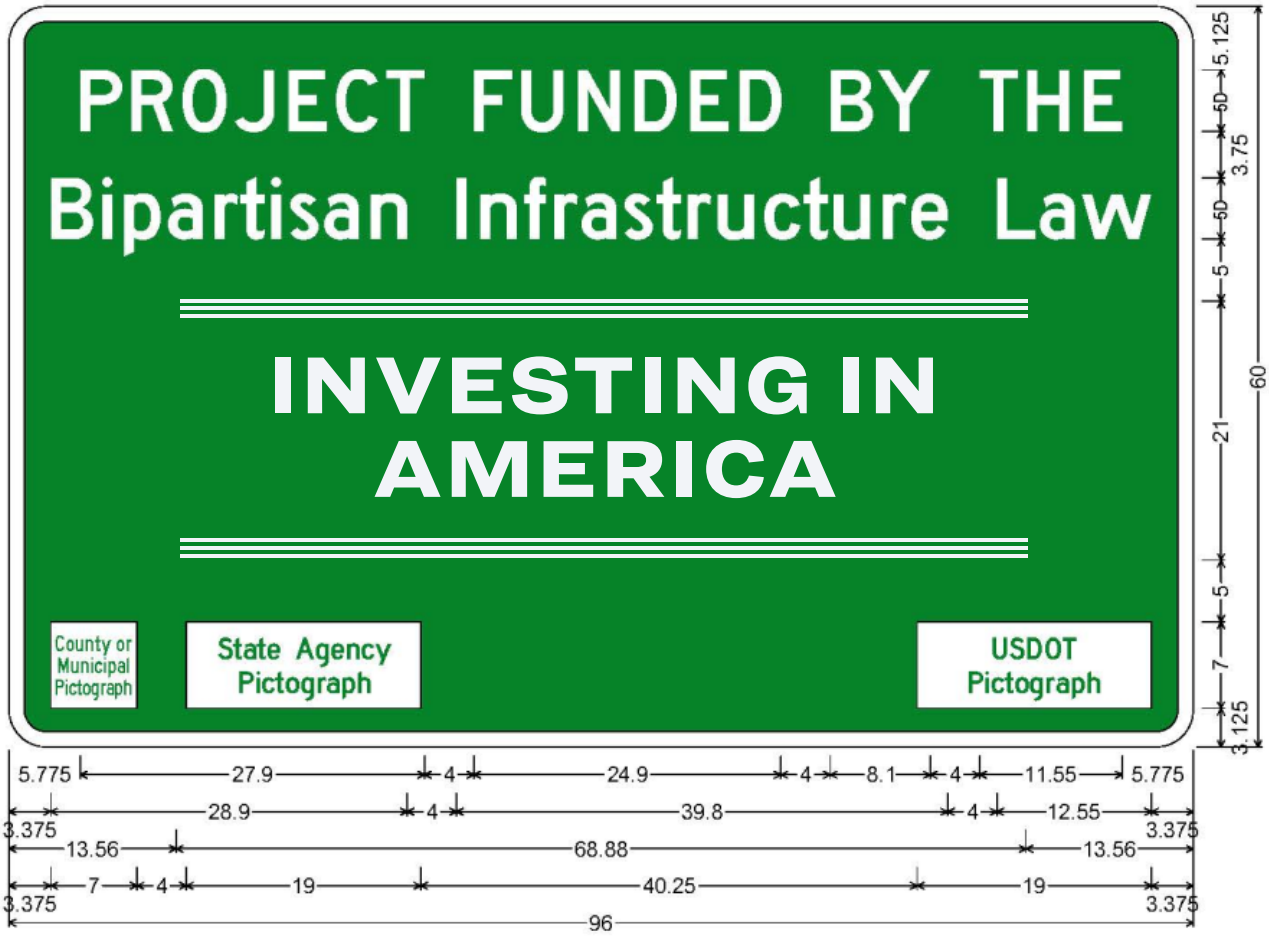
Red Border

State, City, and County Logo Variations

Square or Circular State Logo: 7x7 in.

Rectangular or Oval State Logo: **not** to exceed 17.5 x 7 in.

Rules for Highway Right of Way Signage 8 Feet



Rules for Highway Right of Way Signage 6 Feet