STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

June 22, 2006

JLTC BUILDING #4
CAMP WILLIAMS

UTAH NATIONAL GUARD
RIVERTON, UTAH

DFCM Project Number 06013480

JSA Architects

TABLE OF CONTENTS

Page Numbers

Title Page	1
Table of Contents	2
Notice to Contractors	3
Project Description	4
Project Schedule	5
Bid Form	6
Instructions to Bidders	8
Bid Bond	12
Contractors Sublist Form	13
Fugitive Dust Plan	16
Contractor's Agreement	23
Performance Bond	28
Payment Bond	29
Change Order Form	30
Certificate of Substantial Completion	31

Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.
DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :
Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

JLTC BUILDING #4 CAMP WILLIAMS
UTAH NATIONAL GUARD – RIVERTON, UTAH
DFCM PROJECT NO:06013480

Bids will be in accordance with the Contract Documents that will be available at 4:00 PM on Thursday, June 22, 2006, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, SLC, Utah and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Wayne Smith, DFCM, at (801)550-6536. No others are to be contacted regarding this bidding process. The construction budget for this project is $730,000.00.

A **MANDATORY** pre-bid meeting will be held at 9:00 AM on Wednesday, June 28, 2006 at the JLTC Building #3 at Camp Williams, 17800 South Redwood Road, Riverton, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Wednesday, July 12, 2006, at DFCM, 4ll0 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

Bid security, in the amount of five percent (5%) of the bid, must be submitted as stated in the Instruction to Bidders.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION

The scope of work for this project includes construction of a CMU building as per plans and specifications to include all utility hookup and parking relative to this building. Civil work around the building is also included in the scope of work.

Only qualified contractors who have had proven experience in all phases of this type of construction and/or who have demonstrated successful completion of similar State government construction projects will be allowed to submit bids for this project.

A statement of qualifications will be required to be submitted to DFCM prior to the pre-bid mandatory meeting by all contractors who have not previously contracted with the State. The statement must be specific to this project and include:

> A five-year history of completed similar work projects within the entire scope of work for this particular project. Include specific projects, results, and references.
>
> A management plan for the project to detail the construction process from start to finish with tentative schedules and plans to ensure that the quality and timeliness of the work will satisfy the owner and the state agency and be in accordance with all drawings and specifications

PROJECT SCHEDULE

PROJECT NAME: **JLTC BUILDING #4 - CAMP WILLIAMS**
UTAH NATIONAL GUARD – RIVERTON, UTAH

DFCM PROJECT NO. **06013480**

Event	Day	Date	Time	Place
Bidding Documents Available	Thursday	June 22, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT or DFCM web site *
Mandatory Pre-bid Site Meeting	Wednesday	June 28, 2006	9:00 AM	JLTC Bldg #3 Camp Williams 17800 South Redwood Rd Riverton, Utah
Last Day to Submit Questions	Wednesday	July 5, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT
Final Addendum Issued	Thursday	July 6, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT or DFCM web site *
Prime Contractors Turn In Bid and Bid Bond / Bid Opening in DFCM Conference Room	Wednesday	July 12, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Thursday	July 13, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Project Completion Date	Wednesday	January 31, 2007		

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **JLTC BUILDING #4 – CAMP WILLIAMS – UTAH NATIONAL GUARD – RIVERTON, UTAH – DFCM PROJECT NO. 06013480** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **January 31, 2007** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$750.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. NOTE: A cashier's check cannot be used as a substitute for a bid bond.

3. Contract and Bond

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM's web site at http://dfcm.utah.gov. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Addenda will be posted on DFCM's web site at http://dfcm.utah.gov. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed "DFCM Contractor Performance Rating" form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

11. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

12. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

13. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

15. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and_____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the_____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By:_____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20_____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

SUBCONTRACTORS LIST

FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality
April 20, 1999

GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

_____
Please type/print name clearly

State of _____)
)
County of _____)

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20___, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1a-2 060706

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20_____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1a-2 060706

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

Page _____ of _____page(s)

DFCM FORM 1a-2 060706

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____
AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

The Owner acknowledges receipt of the following closeout and transition materials:

☐ As-built Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ ____calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: $_____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____	by:	_____	
CONTRACTOR (include name of firm)		(Signature)	DATE
_____	by:	_____	
A/E (include name of firm)		(Signature)	DATE
_____	by:	_____	
USING INSTITUTION OR AGENCY		(Signature)	DATE
_____	by:	_____	
DFCM (Owner)		(Signature)	DATE

4110 State Office Building, Salt Lake City, Utah 84114 cc: Parties Noted
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov DFCM, Director

DFCM FORM 1a-2 060706

jsa
ARCHITECTURE
PLANNING
INTERIOR DESIGN

CAMP WILLIAMS

JLTC Building #4
Bluffdale, Utah

DFCM PROJECT
#06013480

JSA PROJECT
#0625

PROJECT MANUAL AND SPECIFICATIONS

05.18.06

Division	Section Title	Pages
DIVISION 1 - GENERAL REQUIREMENTS		
Issued by DFCM		
DIVISION 2 - SITE CONSTRUCTION		
1.	Use local utility district standards	
2.	Use standard and requirements as listed on drawings.	
3.	Use APWA (American Public Works Association) Utah Chapter, manual of standard specifications, current edition.	
DIVISION 3 - CONCRETE		
03300	Cast-in-place Concrete	22
03410	Plant-precast Structural Concrete	6
DIVISION 4 - MASONRY		
04810	Unit Masonry Assemblies	22
DIVISION 5 - METALS		
05120	Structural Steel	10
05310	Steel Deck	5
05400	Cold-Form Metal Framing	5
05500	Metal Fabrications	14
DIVISION 6 - WOOD AND PLASTICS		
06100	Rough Carpentry	19
DIVISION 7 - THERMAL AND MOISTURE PROTECTION		
07115	Bituminous Dampproofing	3
07190	Water Repellents	4
07210	Building Insulation	6
07245	Western One-Kote Stucco system	12
07540	Thermoplastic membrane roofing	14
07620	Sheet Metal Flashing And Trim	12
07720	Roof Accessories	4
07811	Sprayed Fire-Resistive Materials	8
07841	Through-penetration Firestop Systems	7
07920	Joint Sealants	9
DIVISION 8 - DOORS AND WINDOWS		
08110	Steel Doors And Frames	6
08211	Flush Wood Doors	6
08311	Access Doors And Frames	
083323	Overhead Coiling Doors	3
08411	Aluminum-framed Entrances And Storefronts	11
08711	Door Hardware (scheduled By Naming Products)	16
08800	Glazing	7
08814	Mirrored Glass	6
DIVISION 9 - FINISHES		
09100	FRP Wall Panels	3

09260	Gypsum Board Assemblies	17
09512	Acoustic Tile Ceilings	14
09651	Resilient Floor Tile	6
09680	Carpet	5
09911	Painting (consumer Line Products)	18

DIVISION 10 - SPECIALTIES

10155	Toilet Compartment	4
10200	Louvers and Vents	6
10431	Signs	13
10436	Post And Panel Signs	11
10520	Fire-protection Specialties	6
10801	Toilet And Bath Accessories	6

DIVISION 11 - EQUIPMENT
(by owner) Residential Appliances

DIVISION 12 - FURNISHINGS

12356	Kitchen Casework	7
12484	Floor Mats And Frames	4

DIVISION 13 - SPECIAL CONSTRUCTION
Not Used

DIVISION 14 - CONVEYING SYSTEMS
Not Used

DIVISION 15 - MECHANICAL

15010	Basic Mechanical Requirements	12
15060	Hangers and Supports	11
15075	Mechanical Identification	3
15080	Mechanical Insulation	7
15110	Valves	5
15120	Piping Specialties	5
15140	Domestic Water Pumping	8
15150	Sanitary Waste and Vent Piping	6
15160	Storm Drainage Piping	5
15190	Fuel Piping	7
15410	Plumbing Fixtures	6
15480	Domestic Water Heaters	4
15550	Breeching, Chimneys, and Stacks	3
15736	Packaged Rooftop Air Conditioning Units	6
15738	Split-System Air-Conditioning Units	4
15810	Ducts	5
15820	Duct Accessories	5
15830	Fans	4
15855	Diffusers, Registers and Grilles	3
15905	HVAC Instrumentation	3
15940	Sequence of Operation	2
15950	Testing, Adjusting, and Balancing	7

DIVISION 16 - ELECTRICAL

16050 ..... BASIC ELECTRICAL MATERIALS AND METHODS…….… 4
16060 ..... GROUNDING AND BONDING.....……. 5
16072 ..... ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS…….....5
16075 ..... ELECTRICAL IDENTIFICATION.....……. 5
16120 ..... CONDUCTORS AND CABLES.....……. 4
16130 ..... RACEWAYS AND BOXES.....……. 7
16139 ..... CABLE TRAYS.....……. 5
16140 ..... WIRING DEVICES .....……. 5
16145 ..... LIGHTING CONTROL DEVICES……..…….……..…. 5
16410 ..... ENCLOSED SWITCHES AND CIRCUIT BREAKERS.....……. 6
16420 ..... ENCLOSED CONTROLLERS .....……. 6
16442 ..... PANELBOARDS.....……..6
16491 ..... FUSES.....……. 2
16511 ..... INTERIOR LIGHTING .....……. 9
16521 ..... EXTERIOR LIGHTING .....……. 7
16665 ..... TRANSIENT VOLTAGE SURGE SUPPRESSOR (T.V.S.S.).....……. 4
16715 ..... VOICE AND DATA COMMUNICATION CABLING.....…… 12
16720 ..... FIRE ALARM.....……. 8

End of Index

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.
3. Division 3 Section "Concrete Toppings" for metallic and nonmetallic concrete floor toppings.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Fiber reinforcement.
5. Admixtures.

6. Waterstops.
7. Curing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

F. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. Structural 1, B-B, or better, mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips.

1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60, deformed bars.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

F. Galvanized Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.

G. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.

1. Fly Ash: ASTM C 618, Class C or F.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Moderate weathering region, but not less than 3M.
2. Nominal Maximum Aggregate Size: 3/4 inch.

C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

G. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Catexol 1000CL; Axim Concrete Technologies.
b. MCI 2000 or MCI 2005; Cortec Corporation.
c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
d. Rheocrete 222+; Master Builders, Inc.
e. FerroGard-901; Sika Corporation.

2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat, dumbbell with center bulb.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat, dumbbell with center bulb.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Rubber Waterstops:

a. Greenstreak.
b. Progress Unlimited Inc.
c. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
d. Williams Products, Inc.

2. PVC Waterstops:

a. Greenstreak.
b. Meadows: W. R. Meadows, Inc.
c. Murphy: Paul Murphy Plastics Co.
d. Progress Unlimited Inc.
e. Sternson Group.
f. Tamms Industries Co.; Div. of LaPorte Construction Chemicals North America, Inc.
g. Vinylex Corporation.
h. Westec Barrier Technologies; Div. of Western Textile Products, Inc.

D. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
b. Conseal CS-231; Concrete Sealants Inc.
c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
d. Hydrotite; Greenstreak.
e. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
f. Adeka Ultra Seal; Mitsubishi International Corporation.
g. Superstop; Progress Unlimited Inc.

2.7 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils thick:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils thick.
2. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils thick.

B. Vapor Retarder: ASTM E 1745, Class B, five-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; 10 mils thick.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Griffolyn T-85" by Reef Industries Inc.
2. Product: Subject to compliance with requirements, provide "Griffolyn T-85" by Reef Industries Inc.

C. Vapor Retarder: ASTM E 1745, Class A, three-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; laminated to a nonwoven geotextile fabric, 30 mils thick.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Griffolyn T-65G" by Reef Industries Inc.
2. Product: Subject to compliance with requirements, provide "Griffolyn T-65G" by Reef Industries Inc.

D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

E. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

C. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Colors: As selected by Architect from manufacturer's full range for these characteristics.

D. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Unpigmented Mineral Dry-Shake Floor Hardener:

a. Non-Metallic Floor Hardener; Burke Group, LLC (The).
b. Concolor; ChemMasters.
c. Conshake 500; Conspec Marketing & Manufacturing Co., Inc.
d. Quartz Tuff; Dayton Superior Corporation.
e. Surflex; Euclid Chemical Co.
f. Tycron; Kaufman Products, Inc.
g. Colorhard; Lambert Corporation.
h. Quartzplate; L&M Construction Chemicals, Inc.
i. Maximent; Master Builders, Inc.
j. Floor Quartz; Metalcrete Industries.
k. Hard Top; Richmond Screw Anchor Co.
l. Lithochrome Color Hardener; L. M. Scofield Co.
m. Harcol; Sonneborn, Div. of ChemRex, Inc.
n. Durag Premium; Sternson Group.
o. Hard Top; Symons Corporation.

2. Pigmented Mineral Dry-Shake Floor Hardener:

a. Non-Metallic Floor Hardener; Burke Group, LLC (The).
b. Concolor; ChemMasters.
c. Conshake 600; Conspec Marketing & Manufacturing Co., Inc.
d. Quartz Tuff; Dayton Superior Corporation.
e. Surflex; Euclid Chemical Co.
f. Tycron; Kaufman Products, Inc.
g. Colorhard; Lambert Corporation.
h. Quartzplate; L&M Construction Chemicals, Inc.
i. Maximent; Master Builders, Inc.
j. Floor Quartz; Metalcrete Industries.
k. Lithochrome Color Hardener; L. M. Scofield Co.
l. Harcol; Sonneborn, Div. of ChemRex, Inc.
m. Colorplete; Sternson Group.

3. Penetrating Liquid Floor Treatment:

a. Titan Hard; Burke Group, LLC (The).
b. Chemisil Plus; ChemMasters.
c. Intraseal; Conspec Marketing & Manufacturing Co., Inc.
d. Ashford Formula; Curecrete Chemical Co., Inc.
e. Day-Chem Sure Hard; Dayton Superior Corporation.
f. Euco Diamond Hard; Euclid Chemical Co.
g. Seal Hard; L&M Construction Chemicals, Inc.
h. Vexcon Starseal PS; Vexcon Chemicals, Inc.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

H. Products: Subject to compliance with requirements, provide one of the following:

1. Evaporation Retarder:

a. Cimfilm; Axim Concrete Technologies.
b. Finishing Aid Concentrate; Burke Group, LLC (The).
c. Spray-Film; ChemMasters.
d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
e. Sure Film; Dayton Superior Corporation.
f. Eucobar; Euclid Chemical Co.
g. Vapor Aid; Kaufman Products, Inc.
h. Lambco Skin; Lambert Corporation.
i. E-Con; L&M Construction Chemicals, Inc.
j. Confilm; Master Builders, Inc.
k. Waterhold; Metalcrete Industries.
l. Rich Film; Richmond Screw Anchor Co.
m. SikaFilm; Sika Corporation.
n. Finishing Aid; Symons Corporation.
o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.

2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:

a. AH Clear Cure; Anti-Hydro International, Inc.
b. Spartan-Cote; Burke Group, LLC (The).
c. Spray-Cure & Seal 15; ChemMasters.
d. Conspec #1-15 percent solids; Conspec Marketing & Manufacturing Co., Inc.
e. Day-Chem Cure and Seal; Dayton Superior Corporation.
f. Diamond Clear; Euclid Chemical Co.
g. Nitocure S; Fosroc.
h. Cure & Seal 309; Kaufman Products Inc.
i. Lambco 120; Lambert Corporation.
j. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
k. CS-309; W. R. Meadows, Inc.
l. Seal N Kure; Metalcrete Industries.
m. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
n. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.

o. Flortec 14; Sternson Group.
p. Cure & Seal 14 percent; Symons Corporation.
q. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
r. Acrylic Cure; Unitex.
s. Certi-Vex AC 309; Vexcon Chemicals, Inc.

3. Clear, Waterborne, Membrane-Forming Curing Compound:

a. AH Clear Cure WB; Anti-Hydro International, Inc.
b. Klear Kote WB II Regular; Burke Chemicals.
c. Safe-Cure & Seal 20; ChemMasters.
d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
e. Safe Cure and Seal; Dayton Superior Corporation.
f. Aqua Cure VOX; Euclid Chemical Co.
g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
h. Glazecote Sealer-20; Lambert Corporation.
i. Dress & Seal WB; L&M Construction Chemicals, Inc.
j. Vocomp-20; W. R. Meadows, Inc.
k. Metcure; Metalcrete Industries.
l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
o. Florseal W.B.; Sternson Group.
p. Cure & Seal 14 percent E; Symons Corporation.
q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
r. Hydro Seal; Unitex.
s. Starseal 309; Vexcon Chemicals, Inc.

4. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:

a. Spray-Cure & Seal Plus; ChemMasters.
b. UV Super Seal; Lambert Corporation.
c. Lumiseal Plus; L&M Construction Chemicals, Inc.
d. CS-309/30; W. R. Meadows, Inc.
e. Seal N Kure 30; Metalcrete Industries.
f. Rich Seal 31 percent UV; Richmond Screw Anchor Co.
g. Cure & Seal 31 percent UV; Symons Corporation.
h. Certi-Vex AC 1315; Vexcon Chemicals, Inc.

5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:

a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
b. Polyseal WB; ChemMasters.
c. UV Safe Seal; Lambert Corporation.
d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
e. Vocomp-30; W. R. Meadows, Inc.
f. Metcure 30; Metalcrete Industries.
g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

2.10 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

   1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
   2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Slump: 3 inches.
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 1 1/2- to 2 1/2-inch slump.

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
3. Maximum Slump: 3 inches.

E. Post Tensioned Suspended Slabs: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Slump: 3 inches.
3. Maximum allowed water cement ratio of .48.

F. Building Frame Members including columns: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Slump: 3 inches.
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 1 1/2- to 2 1/2-inch slump.
4. Maximum allowed water cement ratio of .48.

G. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

H. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability.

I. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

J. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

K. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete subject to moderate sulfate exposure.

L. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete subject to severe or very severe sulfate exposure.

M. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.

N. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
   1. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.

O. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

P. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

Q. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

R. Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class C, 1/2 inch.
   2. Class D, 1 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

B. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
   a. 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with

bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

   a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

D. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

E. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

F. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 03300

SECTION 03410 - PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following precast concrete units:

1. Window sills

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.

1. Comprehensive engineering analysis [**signed and sealed**] [**certified**] by the qualified professional engineer responsible for its preparation.

a. Include calculated fire-resistance analysis.

D. Samples: For bearing pads.

E. Welding certificates.

F. Material certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements.

1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category **C1**.

B. Design Standards: Comply with ACI 318 and the design recommendations in PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

C. Quality-Control Standard: Comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

E. Calculated Fire Resistance: Where indicated, provide precast structural concrete units whose fire resistance has been calculated according to **PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete,"** and is acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support units only at designated lifting and supporting points shown on Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
3. Plain-Steel Wire: ASTM A 82, as drawn.
4. Deformed-Steel Wire: ASTM A 496.
5. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from **galvanized** steel wire into flat sheets.
6. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
7. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270 (Grade 1725 or 1860), uncoated, 7-wire, low-relaxation strand.

B. Concrete:

1. Portland Cement: ASTM C 150, Type I or Type III, of same type, brand, and source.
2. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class **5S**.
3. Air-Entraining Admixture: ASTM C 260.
4. Fly Ash Admixture: ASTM C 618, Class C or F.
5. Metakaolin Admixture: ASTM C 618, Class N.
6. Silica Fume Admixture: ASTM C 1240.

C. Steel Connections:

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
2. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.

3. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
4. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by **hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable**.

    a. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

5. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply **lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664** according to SSPC-PA 1.

D. Bearing Pads:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.
4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to mild-steel plate, of type required for in-service stress.
5. Hardboard: AHA A135.4, Class 1, tempered hardboard strips, smooth on both sides.
6. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

E. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

F. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

G. Epoxy Grout: ASTM C 881, 2-component epoxy resin, of type, grade, and class to suit requirements.

2.2 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

B. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): **4000 psi** .
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Air Content: **6 percent with a tolerance of plus or minus 1-1/2 percent**].

2.3 FABRICATION

A. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless approved by Architect.

B. Cast-in openings larger than 10 inches (250 mm) in diameter or 10 inches (250 mm) square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Architect.

C. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

D. Prestress tendons for precast structural concrete units by either pretensioning or posttensioning methods. Comply with PCI MNL 116.

E. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.

F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

G. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.

H. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

I. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.

J. Finish formed surfaces of precast structural concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
2. Commercial Finish: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.
3. Grade B Finish: Fill air pockets and holes larger than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of adjacent surfaces. Grind smooth form offsets or fins larger than 1/8 inch (3 mm).

4. Grade A Finish: Fill air pockets and holes larger than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of precast concrete. Grind smooth form offsets or fins larger than 1/8 inch (3 mm). Float-apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles.

K. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.

1. Apply scratch finish to precast concrete units that will receive concrete topping after installation. After initial strikeoff, transversely scarify surface to provide ridges approximately 1/4 inch (6 mm) deep.

L. Recess prestressing tendons a minimum of 1/2 inch (13 mm), fill recesses with grout, and apply a sack finish to vertical ends of precast concrete units.

2.4 SOURCE QUALITY CONTROL

A. Owner will employ an independent testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.

B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.

C. Strength of precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements.

D. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.

B. Install precast structural concrete. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.

C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.

1. Repair damaged steel surfaces by cleaning and [**applying a coat of galvanized repair paint to galvanized**] [**and**] [**repriming damaged painted**] surfaces.

D. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless approved by Architect.

E. Erection Tolerances: Install precast concrete units level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete."

F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints.

G. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

END OF SECTION 03410

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units & Pre-cast concrete
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 7 Section "Bituminous Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
2. Division 7 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
3. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
4. Division 7 Section "Firestopping" for firestopping at tops of masonry walls and at openings in masonry walls.
5. Division 9 Section "Interior Stone Facing" for stone window stools.
6. Division 10 Section "Louvers and Vents" for wall vents (brick vents).

C. Products furnished, but not installed, under this Section include the following:

1. Dovetail slots for masonry anchors, installed under Division 3 Section "Cast-in-Place Concrete."
2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."

D. Products installed, but not furnished, under this Section include the following:

1. Cast-stone trim, furnished under Division 4 Section "Cast Stone."
2. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."
3. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
4. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314] [UBC Standard 21-17.

1. For Concrete Unit Masonry: f'm = 1500 psi.

1.5 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored mortar Samples showing the full range of colors available.

D. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
3. Stone trim samples not less than 12 inches in length, showing the full range of colors and textures expected in the finished construction.
4. Weep holes/vents in color to match mortar color.
5. Accessories embedded in the masonry.

E. Constructing Mockup: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.

2. Mockup: Provide a 48” x 64” mock-up of the standard CMU showing joints and grout workmanship and submit for approval before actual work is started.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

   a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
   b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with property requirements of Standard 21-15.
3. Grout mixes complying with compressive strength requirements of UBC Standard 21-19. Include description of type and proportions of grout ingredients.

H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

   a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
   b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Table 21-D of the Uniform Building Code.
4. Each material and grade indicated for reinforcing bars.
5. Each type and size of joint reinforcement.
6. Each type and size of anchor, tie, and metal accessory.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
   1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
   2. Mortar Test: For mortar properties per UBC Standard 21-16.
   3. Grout Test: For compressive strength per UBC Standard 21-18.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

   1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Section 2104.3 of the Uniform Building Code.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: UBC Standard 21-4 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi Select one of three weights below or delete subparagraph for Contractor's option. Retain ", unless otherwise indicated" for default requirement if more than one weight is used.
2. Weight Classification: Normal weight , unless otherwise indicated.
3. Provide Type I, moisture-controlled units.

4. Size (Width): Manufactured to the following dimensions:
.
a. Provide sizes indicated on the drawings.

5. Type: Manufactured to the following textures:
.
a. Standard, split-face, honed are indicated on the drawings. Each has its own color to be selected from the manufactures range of colors and to match the block on JLTC building #1.

6. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

   a. Where units are to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
   b. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.

C. Decorative Concrete Masonry Units: UBC Standard 21-4 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Weight Classification: Normal weight , unless otherwise indicated.
3. Provide Type I, moisture-controlled units.
4. Provide Type II, nonmoisture-controlled units.
5. Size: Manufactured to dimensions indicated for nondecorative units.
6. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.

   a. Normal-weight aggregate, ground finish.

7. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

   a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Products: Subject to compliance with requirements, provide one of the following:

      1) Block Plus W-10; Addiment Inc.
      2) Dry-Block; W. R. Grace & Co., Construction Products Division.
      3) Rheopel; Master Builders.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207 and UBC Standard 21-13, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

D. Mortar Cement: ASTM C 1329 and UBC Standard 21-14.

E. Masonry Cement: ASTM C 91 and UBC Standard 21-11.

1. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.

F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

1. White-Mortar Aggregates: Natural white sand or ground white stone.
2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

I. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

J. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, refractory mortar; complying with ASTM C 199, medium duty; or an equivalent product acceptable to authorities having jurisdiction.

K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

M. Water: Potable.

N. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

O. Products: Subject to compliance with requirements, provide one of the following:

1. Colored Portland Cement-Lime Mix:

   a. Eaglebond; Blue Circle Cement.
   b. Color Mortar Blend; Glen-Gery Corporation.
   c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
   d. Centurion Colorbond PL; Lafarge Corporation.
   e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
   f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

2. Mortar Cement:

   a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
   b. Lafarge Mortar Cement; Lafarge Corporation.

3. Colored Mortar Cement:

   a. Magnolia Superbond Mortar Cement; Blue Circle Cement.

4. Colored Masonry Cement:

   a. Magnolia Masonry Cement; Blue Circle Cement.
   b. Brixment-in-Color; Essroc Materials, Inc.
   c. Rainbow Mortamix Custom Color Masonry Cement; Holnam, Inc.

d. Centurion Colorbond; Lafarge Corporation.
e. Lehigh Custom Color Masonry Cement; Lehigh Portland Cement Co.
f. Coosa Masonry Cement; National Cement Company, Inc.
g. Flamingo Color Masonry Cement; Riverton Corporation (The).
h. Richcolor Masonry Cement; Southdown, Inc.

5. Mortar Pigments:

a. True Tone Mortar Colors; Davis Colors.
b. Centurion Pigments; Lafarge Corporation.
c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

6. Cold-Weather Admixture:

a. Accelguard 80; Euclid Chemical Co.
b. Morseled; W. R. Grace & Co., Construction Products Division.
c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.

7. Water-Repellent Admixture:

a. Mortar Tite; Addiment Inc.
b. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
c. Rheopel; Master Builders.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615; ASTM A 616, including Supplement 1; or ASTM A 617, Grade 60.

2.4 MASONRY JOINT REINFORCEMENT

A. General: UBC Standard 21-10 and as follows:

1. Mill galvanized, carbon-steel wire for interior walls.
2. Hot-dip galvanized, carbon-steel wire for exterior walls.
3. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
4. Hot-dip galvanized, carbon-steel wire for interior walls.
5. Stainless-steel wire for exterior walls.
6. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
7. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
8. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Mill Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641, Class 1 coating.

C. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

D. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or 316.

E. Galvanized Steel Sheet: ASTM A 653/A 653M, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.

F. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

G. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316.

H. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.6 BENT WIRE TIES

A. General: Rectangular units with closed ends and not less than 4 inches wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.
2. Where wythes are of different materials, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.

B. Wire: Fabricate from **1/4-inch-** diameter, hot-dip galvanized steel wire. Mill galvanized wire ties may be used in interior walls where humidity does not exceed 75 percent.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire anchor section for welding to steel. Mill galvanized wire may be used at interior walls where humidity does not exceed 75 percent.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel wire. Mill galvanized wire may be used at interior walls where humidity does not exceed 75 percent.

2.8 ANCHORS FOR CONNECTING TO CONCRETE

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Dovetail anchor section formed from 0.0966-inch- thick, steel sheet, galvanized after fabrication. 0.064-inch- thick, galvanized sheet may be used at interior walls where humidity does not exceed 75 percent.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel wire. Mill galvanized wire may be used at interior walls where humidity does not exceed 75 percent.

2.9 RIGID ANCHORS

A. General: Fabricate from steel bars as follows:

1. 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins.
2. As indicated.
3. Finish: Hot-dip galvanized to comply with ASTM A 153.

2.10 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

B. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
2. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

   a. Plate 1-1/4 inches wide by 6 inches long with strap 5/8 inch wide by 3-5/8 inches long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch.

3. Anchor Section: Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

   a. Plate 1-1/4 inches wide by 6 inches long with strap 5/8 inch wide by 6 inches long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch.
   b. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.

4. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive tie section and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
5. Wire Tie Section: Triangular-shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
6. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966-inch- thick, steel sheet, galvanized after fabrication Fabricate wire tie sections from 0.25-inch- diameter, hot-dip galvanized steel wire.

C. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and a wire anchor section designed to be slipped into metal studs as sheathing is installed. Anchor section locks in place by fitting to inside of metal stud, and has an eye to receive the wire tie section. Wire tie section has a vertical leg that slips into the eye of the anchor section and allows vertical adjustment. Both sections are made from 3/16-inch, hot-dip galvanized wire.

D. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint, complying with the following requirements:

1. Anchor Section: Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

   a. Plate 1-1/4 inches wide by 6 inches long with strap 5/8 inch wide by 6 inches long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more then 1/32 inch.
   b. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.

2. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
3. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966 inch thick, steel sheet, galvanized after fabrication.
4. Fabricate wire connector sections from 0.25-inch- diameter, hot-dip galvanized steel wire.
5. Continuous Wire: 0.1875-inch- diameter, hot-dip galvanized steel wire.

E. Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:

1. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

F. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange by not less than three exposed threads.

G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

H. Products: Subject to compliance with requirements, provide one of the following:

1. Screw-Attached, Masonry-Veneer Anchors:

   a. D/A 213; Dur-O-Wal, Inc.
   b. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
   c. 315-D with 316; Heckman Building Products, Inc.
   d. Pos-I-Tie; Heckman Building Products, Inc.
   e. DW-10; Hohmann & Barnard, Inc.
   f. DW-10HS; Hohmann & Barnard, Inc.

g. DW-10-X; Hohmann & Barnard, Inc.
h. 1004, Type III; Masonry Reinforcing Corporation of America.
i. RJ-711; Masonry Reinforcing Corporation of America.

2. Slip-in, Masonry-Veneer Anchors:

a. AA308; Hohmann & Barnard, Inc.

3. Seismic Masonry-Veneer Anchors:

a. D/A 213S; Dur-O-Wal, Inc.
b. DW-10-X-Seismiclip; Hohmann & Barnard, Inc.
c. RJ-711 with Wire-Bond clip; Masonry Reinforcing Corporation of America.

4. Organic-Polymer-Coated, Steel Drill Screws:

a. Dril-Flex; Elco Industries, Inc.
b. Traxx; ITW-Buildex.

5. Stainless-Steel Drill Screws for Steel Studs:

a. Stainless Steel SX Fastener; Dur-O-Wal, Inc.

2.11 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet.

C. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
2. Nonheaded bolts, bent in manner indicated.

D. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.
2. Type: Expansion anchors.
3. Type: Undercut anchors.
4. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
5. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
6. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
7. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
2. PVC: ASTM D 2287, Type PVC-65406.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.

E. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches.

F. Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity between wythes.

G. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted to comply with Division 9 Section "Painting," before installation, in color approved by Architect to match that of mortar.

H. Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

I. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.

1. Provide units with either two loops or four loops as needed for number of bars indicated.

J. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:

K. Products: Subject to compliance with requirements, provide one of the following:

1. Vinyl Weep Hole/Vent:

a. Williams-Goodco Brick Vent; Williams Products, Inc.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without

discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching:

      1) 202 New Masonry Detergent; Diedrich Technologies, Inc.
      2) Sure Klean No. 600 Detergent; ProSoCo, Inc.

   b. Cleaners for Red and Dark-Colored Brick Not Subject to Metallic Staining:

      1) 200 Lime Solv; Diedrich Technologies, Inc.
      2) Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.

   c. Cleaners for Brick Subject to Metallic Staining:

      1) 202V Vana-Stop; Diedrich Technologies, Inc.
      2) Sure Klean Vana Trol; ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

   1. Do not use calcium chloride in mortar or grout.
   2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270 and UBC Standard 21-15, BIA M1, Proportion Specification.

   1. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
   2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
   3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
   4. For masonry below grade, in contact with earth, and where indicated, use Type M or RM.
   5. For reinforced masonry and where indicated, use Type S, S or RS, N, N or RN.
   6. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N, N or RN.
   7. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:

1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
2. For carbon-black pigment and portland cement-lime mortar, not more than 2 percent.
3. For mineral-oxide pigments and masonry cement, not more than 5 percent.
4. For carbon-black pigment and masonry cement mortar, not more than 1 percent.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry: Comply with ASTM C 476 and UBC Standard 21-19.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with UBC Table 21-C for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

2.15 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.

C. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
3. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.

C. Set stone trim units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone-joint surface thoroughly before setting; for soiled stone surfaces, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 MASONRY-CELL INSULATION

A. Pour granular insulation into cavities as shown to fill void spaces completely. Maintain inspection ports to show the presence of insulation at the extremities of each pour area. Close the ports after complete coverage has been confirmed. Limit the fall of insulation to 1 story in height, but not to exceed 20 feet.

B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

   a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing and to concrete and masonry backup with two metal fasteners of type indicated.
2. Insert anchor sections in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around the perimeter.
5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints, if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in joint fillers where indicated.
4. Form open joint of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Keep joint free and clear of mortar.

D. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. Install flashing as follows:
1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 12 inches, and behind air-infiltration barrier or building paper.
2. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 7 Section "Joint Sealants" for application indicated.
4. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and Section 2104.5 of the Uniform Building Code.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and Section 2104.6 of the Uniform Building Code for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.14 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar properties will be tested per UBC Standard 21-16.

D. Grout will be sampled and tested for compressive strength per UBC Standard 21-18.

E. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.

F. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

G. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per UBC Standard 21-17, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

3.15 PARGING

A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch. Scarify first parge coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect the parging until cured.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.
8. Clean limestone units to comply with recommendations in the Indiana Limestone Institute of America's "Indiana Limestone Handbook."

3.17 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Prefabricated building columns.
4. Grout.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.
3. Division 9 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

C. Welding certificates.

D. Qualification Data: For installer and fabricator.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
   1. Shop primers.
   2. Nonshrink grout.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Cbd.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

   1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
   3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
   5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
   6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

   1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
   2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Corrosion-Resisting Structural Steel: ASTM A 588/A 588M, Grade 50.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Extra strong.
2. Finish: Galvanized.

H. Medium-Strength Steel Castings: ASTM A 27/A 27M, Grade 65-35, carbon steel.

I. High-Strength Steel Castings: ASTM A 148/A 148M,Grade 80-50, carbon or alloy steel.

J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.

a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

G. Threaded Rods: ASTM A 193/A 193M.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened carbon steel.
3. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

I. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.

J. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 PREFABRICATED BUILDING COLUMNS

A. General: Prefabricated building columns consisting of load-bearing structural-steel members encased in manufacturer's standard insulating concrete for fire protection and enclosed in an outer non-load-bearing steel shell.

1. Concrete Fill: Manufacturer's standard-mix structural concrete, with a minimum 28-day compressive strength of 5000 psi, machine mixed and mechanically vibrated during placement to produce concrete fill free of voids.

B. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.

1. Fire-Resistance Rating: 2 hours.

C. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or as required to suit type of structure indicated.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated building columns that may be incorporated into the Work include, but are not limited to, the following:

E. Manufacturers: Subject to compliance with requirements, provide prefabricated building columns by one of the following:

1. Black Rock Column, Inc.
2. Dean, George H. Inc.
3. Fire-Trol Division; Dean Lally L.P.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
2. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
3. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved in writing by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design," manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.7 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05120

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.
3. Noncomposite form deck.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product certificates.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Research/Evaluation Reports: For steel deck.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Profiles, Inc.
2. Canam Steel Corp.;The Canam Manac Group.
3. Consolidated Systems, Inc.
4. DACS, Inc.
5. D-Mac Industries Inc.
6. Epic Metals Corporation.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Division.
10. Roof Deck, Inc.
11. United Steel Deck, Inc.
12. Valley Joist; Division of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade **33** minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: See Architects drawings.

2. Deck Profile: See Architects drawings.
3. Profile Depth: **1-1/2 inches** .

4. Design Uncoated-Steel Thickness: [**As indicated**].

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, requirements in this Section, and as indicated.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work. Provide manufacturer’s specifications to Architect and Engineer for approval.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

H. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).

I. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and [**weld**] or [**mechanically fasten**] flanges to top of deck. Space [**welds**] not more than 12 inches (305 mm) apart with at least one [**weld**] at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and [**weld**] [**or**] [**mechanically fasten**].

J. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. [**Weld**] [**or**] [**mechanically fasten**] to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

K. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

L. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: **Owner will engage** a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.3 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on **both surfaces** of prime-painted deck immediately after installation, and apply repair paint.

END OF SECTION 05310

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Floor joist framing.
5. Roof trusses.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: **As indicated.**

2. Deflection Limits: Design framing systems to withstand[**design loads**] without deflections greater than the following:
   a. Live loads – L/360 total lodas – L/240.

1.3 SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification data.

E. Product test reports.

F. Research/evaluation reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

E. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A653, metallic coated, of grade and coating weight as follows:

1. Grade: **ST33H**
2. Coating: [**G60 or equivalent**].

2.2 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

C. Anchor Bolts: ASTM F 1554, Grade [**36**], threaded carbon-steel [**hex-headed bolts**] and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by [**hot-dip process according to ASTM A 153, Class C**].

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10

times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.3 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: [**ASTM A 780**].

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place,

undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel ladder..
2. Loose bearing and leveling plates.
3. Loose steel lintels.
4. Shelf angles.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Miscellaneous metal trim.

B. Related Sections include the following:

1. Division 5 Section "Structural Steel" for structural-steel framing system components.
2. Division 5 Section "Gratings" for metal gratings.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

H. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.

1. Width of Channels: 1-5/8 inches.
2. Depth of Channels: 1-5/8 inches.
3. Depth of Channels: As indicated.
4. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.108-inch nominal thickness.
5. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.079-inch nominal thickness.
6. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.064-inch nominal thickness.
7. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 0.0966-inch minimum thickness.
8. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 0.0677-inch minimum thickness.
9. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 0.0528-inch minimum thickness.
10. Finish: Unfinished.
11. Finish: Rust-inhibitive, baked-on, acrylic enamel.
12. Finish: Hot-dip galvanized after fabrication.

I. Malleable-Iron Castings: ASTM A 47, Grade 32510.

J. Gray-Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

K. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.4 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline 621; Carboline Company.
b. Aquapon Zinc-Rich Primer 97-670; PPG Industries, Inc.
c. Tneme-Zinc 90-97; Tnemec Company, Inc.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1.

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.6 GROUT

A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.

C. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges, spaced 16 inches apart.

D. Bar Rungs: 3/4-inch- diameter steel bars, spaced 12 inches o.c.

E. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

F. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

G. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Mebac; IKG Borden.
b. SLIP-NOT; W. S. Molnar Company.

H. Galvanize ladders, including brackets and fasteners, in the following locations:

1. Exterior.
2. Interior, where indicated.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.12 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

C. Galvanize shelf angles to be installed in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.13 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

D. Fabricate supports for operable partitions as follows:

1. Beams: Continuous steel shapes of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

E. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.

F. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.

1. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

G. Galvanize miscellaneous framing and supports where indicated.

2.14 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.
2. Interior, where indicated.

2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.18 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch greater than OD of bollard. After bollards have been inserted into holes, fill annular space surrounding bollard solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.

D. Anchor bollards to existing construction with postinstalled anchors and bolts. Provide four 3/4-inch anchors at each bollard, unless otherwise indicated. Embed anchors at least 4 inches in existing concrete.

E. Anchor internal sleeves for removable bollards in concrete by inserting into pipe sleeves preset into concrete. After internal sleeves have been inserted, fill annular space between sleeves solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.

F. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 8 inches deep and 3/4 inch greater than OD of sleeve. After sleeves have been inserted into holes, fill annular space surrounding sleeves solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward sleeve.

G. Anchor internal sleeves for removable bollards in place with concrete footings. Support and brace sleeves in position in footing excavations until concrete has been placed and cured.

1. Place removable bollards over internal sleeves and secure with 1/2-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

H. Fill bollards solidly with concrete, mounding top surface.

1. Do not fill removable bollards with concrete.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking, cants, and nailers..

B. Related Sections include the following:

   1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Exposed Framing: Dimension lumber not concealed by other construction.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.
   3. RIS - Redwood Inspection Service.
   4. SPIB - Southern Pine Inspection Bureau.
   5. WCLIB - West Coast Lumber Inspection Bureau.
   6. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood
2. Foam-plastic sheathing.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.
7. Building wrap.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

C. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Building Wrap:

a. Celotex Corporation (The); Building Products Division.
b. DuPont (E. I. du Pont de Nemours and Company).
c. Parsec, Inc.
d. Raven Industries, Inc.

e. Reemay, Inc.
f. Simplex Products.
g. Sto-Cote Products, Inc.
h. Tenneco Building Products.

2. Metal Framing Anchors:

a. Alpine Engineered Products, Inc.
b. Cleveland Steel Specialty Co.
c. Harlen Metal Products, Inc.
d. KC Metals Products, Inc.
e. Silver Metal Products, Inc.
f. Simpson Strong-Tie Company, Inc.
g. Southeastern Metals Manufacturing Co., Inc.
h. United Steel Products Company, Inc.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
6. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

a. Chromated copper arsenate (CCA).
b. Ammoniacal copper zinc arsenate (ACZA).
c. Ammoniacal, or amine, copper quat (ACQ).
d. Copper bis (dimethyldithiocarbamate) (CDDC).
e. Ammoniacal copper citrate (CC).
f. Copper azole, Type A (CBA-A).
g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
1. Construction grade.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:

1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:
1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
2. Eastern softwoods; NELMA.
3. Northern species; NLGA.
4. Western woods; WCLIB or WWPA.

C. For exposed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Finish or 1 Common (Colonial) grade; NELMA, NLGA, WCLIB, or WWPA.
2. Hem-fir or Hem-fir (north), Prime or D Finish grade; NLGA, WCLIB, or WWPA.
3. Western red cedar, A grade; NLGA or WWPA.

D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Hem-fir or Hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
   2. Eastern softwoods, No. 2 Common grade; NELMA.
   3. Northern species, No. 2 Common grade; NLGA.
   4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
   1.

2.6 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1..

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:

1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

C. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316.

1. Use for exterior locations and where indicated.

D. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.062 inch.

E. I-Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

1. Thickness: 0.062 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 1-1/2 inches or 2 inches.
2. Thickness: 0.050 inch or 0.062 inch.

G. Bridging: Rigid, V-section, nailless type, 0.062 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 3/4 inch or 1-1/4 inches.
2. Thickness: 0.062 inch.
3. Length: As indicated.

J. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

K. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

L. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

M. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: 5/8 inch or as indicated.
2. Width: 2-1/2 inches.
3. Body Thickness: 0.138 inch.
4. Base Reinforcement Thickness: 0.239 inch.

N. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

O. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.9 MISCELLANEOUS MATERIALS

A. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in sheathing and recommended by sheathing manufacturer for use with type of sheathing required.

B. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

C. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

D. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.

3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.
6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.

E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Fire block furred spaces of walls, at each floor level and at ceiling, with wood blocking or noncombustible materials accurately fitted to close furred spaces.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

D. Furring to Receive Plaster Lath: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.4 WOOD FRAMING INSTALLATION, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Do not splice structural members between supports.

D. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are required, fasten together with 2 rows of 20d nails spaced not less than 32 inches o.c. Locate one row near top edge and other near bottom edge.

1. For continuous members, stagger end joints at quarter points between supports or locate end joints over supports.

END OF SECTION 06100

SECTION 07115 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hot-applied asphalt dampproofing applied to the following surfaces:

1. Exterior, below-grade surfaces of concrete foundation walls.
2. Back side of concrete and masonry retaining walls, below grade.
3. Exterior face of concrete and masonry indicated to receive stone veneer assemblies.

B. Related Sections include Division 7 Section "Self-Adhering Sheet, Cold Fluid-Applied and Hot Fluid-Applied Waterproofing" for waterproofing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hot-Applied Asphalt Dampproofing:

   a. Meadows, W. R., Inc.
   b. Owens Corning; Trumbull Division.
   c. Pre-Approved Equal

2.2 BITUMINOUS DAMPPROOFING

A. Hot-Applied Asphalt Dampproofing: ASTM D 449, Type I.

2.3 MISCELLANEOUS MATERIALS

A. Cut-Back Asphalt Primer: ASTM D 41.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

~~D. Protection Course, Asphalt Board Type: Premolded, 1/8 inch thick, multi-ply, semirigid board consisting of a mineral stabilized asphalt core sandwiched between layers of asphalt saturated felt, and faced on 1 side with polyethylene film.~~

~~E. Protection Course, Polystyrene Type: Fan folded, rigid, extruded polystyrene board insulation; nominal thickness not less than 3/16 inch.~~

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

   1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior whether indicated or not.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

3.4 HOT-APPLIED ASPHALT DAMPPROOFING

A. Do not apply hot asphalt when substrate condition causes foaming.

B. Prime masonry and other porous substrates.

C. Apply a uniform coat of hot asphalt by mopping or spraying at not less than 20 lb or 2.5 gal./100 sq. ft..

D. Apply a second coat to below-grade foundation walls as specified above. Apply double thickness of second coat where first application has failed to produce a smooth, shiny, impervious coat.

~~3.5 INSTALLATION OF PROTECTION COURSE~~

A. ~~Where indicated, install protection course over completed and cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.~~

3.6 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07115

SECTION 07190 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes clear water-repellent coatings for the following vertical and nontraffic horizontal surfaces:

1. Concrete (unpainted).
2. Masonry

B. Related Sections include the following:

1. Division 3 Sections for concrete work including floor sealers and curing agents, precast concrete, and concrete restoration and cleaning.
2. Division 7 Section "Joint Sealants" for joint sealants.
3. Division 7 Sections for fluid-applied waterproofing and dampproofing.
4. Division 9 Section "Painting" for paints and coatings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
   a. Stone: ASTM C 97.
   b. Hardened Concrete: ASTM C 642.

2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
6. Chloride-Ion Intrusion in Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.

   a. Reduction of Water Absorption: 80 percent.
   b. Reduction in Chloride Content: 80 percent.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Samples: Of each substrate indicated to receive water repellent, 12 inches square, with specified repellent treatment applied to half of each sample.

C. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.

D. Certification by water repellent manufacturer that products supplied comply with local regulations controlling use of VOCs.

E. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.

B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.

C. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.

D. Field Samples: Architect will select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.

1. Obtain Architect's approval of field samples before applying water repellents.
2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

1.6 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40 deg F.
2. Concrete surfaces and mortar have cured for less than 28 days.
3. Rain or temperatures below 40 deg F are predicted within 24 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen or surface temperature is less than 40 deg F.
6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Silanes: With more than 3.3 lb/gal. VOCs.

2.2 WATER REPELLENTS

A. Silanes, 20 Percent Solids: Penetrating water repellent. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water, or other proprietary solvent carrier.

PART 3 - EXECUTION

3.1 LOCATIONS

A. Seal all exposed concrete floors as designated on the floor finish schedule on the drawings and below:
1. Storage Rooms
2. Mechanical Rooms
3. Electrical Rooms
4. Fire Riser/Water Room
5. Any concrete floor with no other floor finish as specified in Section 9 – Finishes.
6. Exposed unpainted cmu.

3.2 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.

1. Formed Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.

B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

1. Revisions of planned application, if any, as requested by Architect, will be by Change Order if they constitute a departure from requirements of Contract Documents at the time of contracting.

3.3 APPLICATION

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.5 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07190

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Foundation insulation.
2. Concealed building insulation.
3. Vapor retarders.
4. Sound Insulation.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete."
2. Division 7 Section “Dampproofing”
3. Division 7 Section “Thermoplastic Roofing”
4. Division 9 Section "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
5. Division 15 Sections "Duct Insulation," "Equipment Insulation," and "Pipe Insulation."

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Manufacturers: Provide insulation materials by one of the following:
1. Glass Fiber Insulation:
   a. CertainTeed Corporation.
   b. Johns Manville Corporation.
   c. Knauf Fiber Glass.
   d. Owens Corning.

C. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:

1. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.

D. Insulation Schedule:

1. Description: Thermal insulation as follows:

Location	Insula-tion Type	Nominal Thick-ness	"R" Value	Remarks
Perimeter at basement	Rigid	2”	R-8	
Exterior Walls				
	Batt	6"	R-19	Kraft faced
	Batt	4”	R-13	Foil faced
Roof	Rigid	4”	R-18	1.25 Density
Walls around training and Work Rooms	Batt-Sound	6”	R-19	Kraft faced
Ductwork	Dbl. Faced	½”		See Mechanical
Plumbing Lines				See Plumbin

Vinyl Faced 1”

2.2 AUXILIARY INSULATING MATERIALS

A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.3 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
   a. Ceiling plenums.
   b. Attic spaces.
   c. Where indicated.

D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
1. Air Space: 2 inches.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

D. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

1. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
2. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

C. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07245 – **Western One-Kote Stucco system And Finestone Finish**

PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit finish samples for each type of application, color and finish specified. Samples to be a minimum of 12” x 12”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Westen Stucco Product Co., Inc.’s Western 1-Kote exterior stucco system

B. Degussa’s Finestone see section 09220

2.2 WALLS

A. This is to be a 2-part system with a base coat of Western One-Kote identified in this specification section and the finish coat by Degussa’s Finestone identified in 09220. The Western One-Kote per applicable sections in ER-3899 – No insulation board or rated assemblies are required. Application is over solid backing of 7/16” OSB per architectural details.

2.3 SOFFITS

A. A 2-part system of a stucco prime and finish coat by Degussa’s Finestone identified in 09220.

PART 3 – EXECUTION

3.1 Install per drawings and details, building codes, manufacturer’s recommendations and according to ICBO report ER-3899. See Attached doument for additional information and requirements.

END OF SECTION 07245

WESTERN 1-KOTE EXTERIOR STUCCO SYSTEM, MASTER WALL ONE COAT STUCCO SYSTEM, DRYVIT STUCCO PLUS SYSTEMS AND STO POWERWALL® STUCCO SYSTEM, AND EXTERIOR CEMENT PLASTER

WESTERN STUCCO PRODUCTS CO., INC.
6101 NORTH 53RD DRIVE
POST OFFICE BOX 968
GLENDALE, ARIZONA 85311

DRYVIT SYSTEMS, INC.
ONE ENERGY WAY
WEST WARWICK, RHODE ISLAND 02893

STO CORP.
6175 RIVERSIDE DRIVE
ATLANTA, GEORGIA 30331

1.0 SUBJECT

Western 1-Kote Exterior Stucco System, Master Wall One Coat Stucco System, Dryvit Stucco Plus System and Sto Powerwall Stucco System, and Exterior Cement Plaster.

2.0 DESCRIPTION

2.1 One-coat Stucco Systems:

2.1.1 General: The Western 1-Kote Exterior Stucco System, Master Wall Powerwall Stucco System, Dryvit Stucco Plus System and Sto One-coat Stucco System are exterior cementitious one-coat stucco wall-coating systems. See Table 1 for the company names, system names and product names. The systems consist of a proprietary stucco reinforced with wire fabric or metal lath. The systems are applied to substrates of expanded polystyrene (EPS) or extruded polystyrene (XEPS) insulation board, gypsum sheathing board, fiberboard, plywood, or oriented strand board (OSB). The systems are installed on exterior walls of wood- or steel-stud construction.

2.1.2 Materials:

2.1.2.1 Western 1-Kote Stucco, OCS, Stucco Plus Concentrate, and Sto Powerwall Stucco: The materials are factory-prepared mixtures of Type I or II portland cement complying with ASTM C 150-94, lime, chopped fibers, and proprietary additives. The dry cementitious mixture is packaged in 80-pound (36 kg) bags. Four and one half to six gallons (17 to 23 L) of water and 180 to 200 pounds (82 to 91 kg) of sand are added to each bag, in the field, and the components are mixed in accordance with the manufacturer's recommendations. Alternatively, the stucco product is premixed with sand and is packaged in 90-pound (40.8 kg) bags. The premixed stucco product is field-mixed with 3 gallons (11.5 L) of water per bag of stucco product.

Approved color pigments may be added to the stucco mix in accordance with the manufacturer's instructions.

2.1.2.2 Sand: Sand must be clean and free from deleterious amounts of loam, clay, silt, soluble salts and organic matter. Sampling and testing must comply with ASTM C 144. Sand must be graded within the following limits:

RETAINED ON U.S. STANDARD SIEVE	PERCENT RETAINED BY WEIGHT ± 2 PERCENT	
	Minimum	Maximum
No. 4	—	0
No. 8	0	10
No. 16	10	40
No. 30	30	65
No. 50	70	90
No. 100	95	100

2.1.2.3 Insulation Board:

2.1.2.3.1 Expanded Polystyrene Insulation Board: EPS boards must have a nominal density of 1.5 pounds per cubic foot (24 kg/m^3), a Class I flame-spread classification and a smoke-developed rating not exceeding 450. Boards installed without sheathing over open framing must be 1 to 1$^1/_2$ inches (25.4 to 38 mm) thick and provided with $^3/_8$-inch-high (9.5 mm) tongues with compatible grooves for horizontal joints. See Figure 1 for joint detail. All boards must be recognized in a current ICBO ES evaluation report. See Section 2.3 for board identification.

2.1.2.3.2 Extruded Polystyrene Insulation Board: XEPS boards must have a minimum density of 1.6 pounds per cubic foot (25.6 kg/m^3). See Section 2.1.2.3.1 for other details and requirements.

2.1.2.3.3 Fome-Cor Board Lathing Material: The material is nominal $^1/_4$-inch-thick XEPS foam plastic identified as Fome-Cor Board Lathing Material in ICBO ES evaluation report ER-3335.

2.1.2.4 Lath:

2.1.2.4.1 Wire Fabric Lath: The lath is minimum No. 20 gage, 1-inch (25.4 mm), galvanized steel woven-wire fabric. Lath must be self-furred or furred when applied over all substrates except unbacked polystyrene board. Self-furring lath for coatings must comply with the following requirements:

1. The maximum total coating thickness is $^1/_2$ inch (12.7 mm).
2. Furring crimps must be provided at maximum 6-inch (152 mm) intervals each way. The crimps must fur the body of the lath a minimum of $^1/_8$ inch (3.2 mm) from the substrate after installation.

2.1.2.4.2 Metal Lath: The metal lath complies with Table 25-B of the 1997 *Uniform Building Code*™ (UBC). Furring and self-furring requirements are as set forth for wire fabric lath.

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2.1.2.5 Gypsum Sheathing Board: The gypsum sheathing board is water-resistant core gypsum sheathing complying with ASTM C 79-92.

2.1.2.6 Backerboard: The backerboard is gypsum backerboard complying with ASTM C 630-92.

2.1.2.7 Veneer Base: The veneer base is gypsum veneer base complying with ASTM C 588-92.

2.1.2.8 Fiberboard: The fiberboard is minimum $^1/_2$-inch-thick (12.7 mm), asphalt-impregnated fiberboard complying with ANSI/AHA A194.1-1985 as a regular-density sheathing.

2.1.2.9 Wood-based Structural Panels: The panels must be minimum $^3/_8$-inch-thick (8 mm) plywood or OSB with exterior glue, for studs spaced 16 inches (406 mm) on center, and must be minimum $^5/_8$-inch-thick (15.9 mm) plywood for studs spaced 24 inches (610 mm) on center. Plywood must comply with UBC Standard 23-2, and OSB must comply with UBC Standard 23-3.

2.1.2.10 Caulking: The caulking either is acrylic latex caulking material complying with ASTM C 834 or is polyurethane, polyurethane modified, polysulfide or silyl-terminated sealant complying with ASTM C 920.

2.1.2.11 Weather-resistive Barrier: Either minimum Grade D kraft building paper complying with UBC Standard 14-1, or asphalt-saturated rag felt complying with UL Standard 55-A-1983, is required. The weather-resistive barrier must be placed over all substrates, except for the polystyrene insulation board, where the barrier may be behind the board. Application of the barrier must comply with Section 1402.1 of the UBC and this report. When applied over any wood-based sheathing, the barrier must be either two layers of Grade D building paper, as set forth in Section 2506.4 of the UBC; or one layer of minimum 1-inch-thick (25.4 mm) EPS or XEPS having tongue-and-groove edges as described in Sections 2.1.2.3.1 and 2.1.2.3.2 of this report, over one layer of Grade D building paper having a minimum water-resistance rating of 60 minutes when tested in accordance with UBC Standard 14-1.

2.1.2.12 Finish Coat: Portland cement color coat, paints, acrylic textured finishes and elastomeric coatings are finishes that are acceptable to Western Stucco Products Co., Inc., and the additional listees in this report. The finish coat manufacturer's recommendations shall be followed regarding basecoat preparations, bonding, application and curing.

2.1.2.13 Miscellaneous: All trim, screeds and corner reinforcement must be galvanized steel or approved plastic.

2.1.3 Installation:

2.1.3.1 General: The exterior cementitious coating is applied, by hand-troweling or machine-spraying in one or two coats, to a minimum $^3/_8$-inch (9.5 mm) thickness. The lath must be embedded in the minimum coating thickness, and therefore cannot be exposed. An exterior stucco finish coat, if required, may be applied without a bonding agent if applied within 72 hours of base-coat application. After 72 hours, a bonding agent, applied directly to the base coat or added to the finish coat mix, is required. The time period requirements for application of finish-coat products is at the discretion of the coating manufacturer. Flashing, corner reinforcement, metal trim and weep screeds must be installed as shown in the figures of this report. See Figure 2.

The ambient air temperature range for application of the coating is from 40°F to 110°F (4.4°C to 43.3°C); the coating is applied by applicators approved by Western Stucco Products Co., Inc., Master Wall Inc., Dryvit Systems, Inc., or Sto Corp., as applicable. The weather-resistive barrier must be applied as set forth in Section 2.1.2.11. An installation card, as shown in Figure 3, must include the name of the applicator and the product to be used, and must be on the jobsite before any weather-resistive barrier or exterior sheathing is installed. Also, see Section 4.7 of this report.

2.1.3.2 Application over Open Framing:

2.1.3.2.1 Insulation Board: The weather-resistive barrier is attached to open wood studs spaced a maximum of 24 inches (610 mm) on center.

The EPS or XEPS board described in Section 2.1.2.3 is then placed horizontally with tongues faced upward, and is temporarily held in place with galvanized staples or roofing nails. Vertical butt joints must be staggered a minimum of one stud space from adjacent courses and must occur directly over studs. The wire fabric or metal lath is then applied with $1^1/_2$-inch (38 mm) end and side laps tightly over the polystyrene boards, and fastened through the boards to wood studs with a minimum 1-inch (25.4 mm) penetration, using either No. 11 gage galvanized roofing nails with $^3/_8$-inch-diameter (9.5 mm) heads or No. 16 gage galvanized staples spaced 6 inches (152 mm) on center. Staples must have a minimum crown width of $^7/_{16}$ inch (11.1 mm). Wood species must have a specific gravity of 0.50 or greater, such as Douglas fir-larch. Care must be taken to avoid over-driving fasteners. Wall bracing in accordance with Section 2320.11.3 or 2320.11.4 of the UBC, or an acceptable alternate, is required. Application to minimum No. 20 gage steel studs is similar, except that No. 6 Type S screws are installed at 6 inches (152 mm) on center. Screws must penetrate studs a minimum of $^1/_4$ inch (6.4 mm). Steel stud spacing is a maximum of 24 inches (610 mm) on center. Outside wall corners and parapet corners are covered with additional metal corner reinforcement as shown in Figure 2.

Weep screeds must comply with, and be installed at the bottom of the wall in accordance with, Section 2506.5 of the UBC. Galvanized steel, $1^3/_8$-inch (35 mm), J-shaped trim pieces are installed at other areas where foam is exposed. At windows and doors, butting J-trim metal edges must be caulked. Holes for hose bibbs, electrical panels and other penetrations of substrate surfaces, except those caused by fasteners, must also be caulked. The coating is then applied as described in Section 2.1.3.1.

2.1.3.2.2 Fome-Cor Board Lathing Material: The weather-resistive barrier is attached to wood framing spaced a maximum of 24 inches (610 mm) on center. The Fome-Cor Board Lathing Material is installed over the weather-resistive barrier and is attached to the framing in accordance with ICBO ES evaluation report ER-3335. Minimum $1^1/_2$-inch (38 mm) by No. 17 gage, woven-wire fabric lath is attached through the Fome-Cor Board Lathing Material in accordance with Table 25-C of the UBC, using No. 11 gage nails or No. 16 gage staples having a 1-inch (25.4 mm) crown. All fasteners must penetrate a minimum of 1 inch (25.4 mm) into the framing. Wood species must have a specific gravity of 0.50 or greater, such as Douglas fir-larch. The exterior cementitious coating is then applied to a minimum $^1/_2$-inch (12.7 mm) thickness. A minimum $^1/_8$-inch-thick (3.2 mm) finish coat of the exterior cementitious coating material follows, resulting in a minimum $^5/_8$-inch (15.9 mm) overall thickness. The base coat must be cured in accordance with Section 2.1.7.3 prior to finish coat application. Other installation details are described in Section 2.1.3.2.1.

2.1.3.3 Application over Solid Backing:

2.1.3.3.1 Fiberboard: Minimum $^1/_2$-inch-thick (12.7 mm) fiberboard sheathing is installed directly over wood studs spaced a maximum of 24 inches (610 mm) on center. The fiberboard is temporarily held in place with corrosion-resistant staples or roofing nails. A weather-resistive barrier as set forth in Section 2.1.2.11 is applied over the fiberboard prior

to installation of wire fabric or metal lath, or optional insulation board. The vertical joints of the insulation board must be staggered from adjacent courses a minimum of 3 inches (76 mm). Insulation board must be attached to the framing, but the vertical joints of the insulation board are not required to align with the framing. The wire fabric or metal lath is attached to studs through the weather-resistive barrier and sheathing, with fasteners and spacings as described for insulation boards either in Section 2.1.3.2.1 of this report or in Table 23-II-B-1 of the UBC, whichever is more restrictive. Wood framing must be of a species having a specific gravity of 0.50 or greater, such as Douglas fir-larch. The system may also be applied to minimum No. 20 gage [0.036 inch (0.914 mm) thick] steel studs spaced 24 inches (610 mm) on center. System application is similar to that for wood studs, except No. 8, 0.161-inch-diameter-shank (0.41 mm), 0.420-inch-diameter-head (10.7 mm), minimum $1^3/_4$-inch-long (44.5 mm) self-tapping screws secure the lath and sheathing. Screw penetration is a minimum of $^1/_4$ inch (6.4 mm) beyond the steel stud. All walls must be braced in accordance with the UBC. Exposed sheathing edges are protected with screeds. Holes in the substrate surface are caulked and the coating is applied as described in Section 2.1.3.1.

2.1.3.3.2 Gypsum Sheathing: Minimum $^1/_2$-inch-thick (12.7 mm), water-resistant core gypsum sheathing may be installed directly on wood studs in a manner similar to that for fiberboard. The sheathing may also be installed on No. 20 gage [0.036 inch (0.914 mm) thick] steel studs. Gypsum sheathing is fastened in accordance with Table 25-G of the UBC. A weather-resistive barrier is required over the gypsum sheathing prior to installation of the lath and coating as described in Section 2.1.3.2.

2.1.3.3.3 Wood-based Structural Sheathing: Plywood or OSB must be applied directly to wood studs as set forth in Section 2.1.2.9 of this report and Table 23-IV-D-1 of the UBC. The weather-resistive barrier, optional insulation board, lath and coating are applied as decribed for fiberboard in Section 2.1.3.3.1 of this report.

2.1.4 One-hour Fire-resistive Limited Load-bearing Wall Assemblies:

2.1.4.1 First Assembly:

2.1.4.1.1 Interior Face: One layer of $^5/_8$-inch-thick (15.9 mm), Type X gypsum wallboard, water-resistant backerboard or veneer base is applied parallel or at right angles to the interior face of 2-by-4 wood studs spaced a maximum of 24 inches (610 mm) on center. The gypsum boards are attached using 6d coated nails, $1^7/_8$ inches (48 mm) long with a $^1/_4$-inch-diameter (6.4 mm) head, at 7 inches (178 mm) on center to studs, plates and blocking. All gypsum board joints must be backed with wood framing and must be taped and, along with fastener heads, treated with joint compound.

2.1.4.1.2 Exterior Face: One layer of minimum $^5/_8$-inch-thick (15.9 mm), 48-inch-wide (1219 mm), Type X, water-resistant core gypsum sheathing is applied parallel to studs using No. 11 gage galvanized roofing nails, $1^3/_4$ inches (44.5 mm) long with a $^7/_{16}$-inch- or $^1/_2$-inch-diameter (11.1 mm or 12.7 mm) head, at 4 inches (102 mm) on center at board edges and 7 inches (178 mm) on center at intermediate studs. The sheathing is nailed to top and bottom plates at 7 inches (178 mm) on center. A weather-resistive barrier complying with Section 2.1.2.11 of this report is required over the sheathing. The wire fabric lath and wall coating are then applied as described in Section 2.1.3.2.

2.1.4.2 Second Assembly:

2.1.4.2.1 Interior Face: One layer of $^5/_8$-inch-thick (15.9 mm), Type X gypsum wallboard is applied horizontally to wood studs spaced a maximum of 16 inches (406 mm) on center. The wallboard is attached, using $1^5/_8$-inch-long (41.3 mm), No. 13 gage, gypsum wallboard nails having a $^{19}/_{64}$-inch-diameter (7.5 mm) head, at 6 inches (152 mm) on center around board edges and to studs and blocking. All wallboard joints must be backed by wood framing and taped and treated with joint compound. Fastener heads must be treated with joint compound.

2.1.4.2.2 Exterior Face: Three-and-five-eighths-inch-thick (92 mm), 15-inch-wide (381 mm), R-13, 1.72 pcf density (27.6 kg/m^3), mineral wool batts, having a vapor barrier on one face, are stapled to one face of the framing members. One layer of $^1/_2$-inch-thick (12.7 mm), water-resistant core gypsum sheathing is fastened to the studs as described for gypsum wallboard in Section 2.1.4.2.1 of this report. A weather-resistive barrier of kraft waterproof paper complying with UBC Standard 14-1 is applied over the sheathing in accordance with the code. The 1-inch (25.4 mm) by No. 20 gage galvanized wire fabric lath and the wall coating are applied over the sheathing and weather-resistive barrier in accordance with Section 2.1.3.3.2 of this report. No foam plastic insulation is permitted.

2.1.4.3 Third Assembly:

2.1.4.3.1 Interior Face: One layer of $^5/_8$-inch-thick (15.9 mm), Type X gypsum wallboard is applied to nominal 2-by-4 wood studs spaced a maximum of 24 inches (610 mm) on center, with the gypsum wallboard's long dimension horizontal. Horizontal solid blocking must be installed at the wall midheight. The wallboard is attached with $1^5/_8$-inch-long (41.3 mm), cupped-head gypsum wallboard nails with a 0.30-inch-diameter (7.62 mm) head and 0.10-inch-diameter (0.254 mm) shank. The fasteners are spaced a maximum of 8 inches (203 mm) on all studs, plates and blocking. Wallboard joints must be covered with paper tape and gypsum joint compound. Fastener head must also be treated with joint compound. Kraft-paper-faced, $3^1/_2$-inch-thick (89 mm), R-11, fiberglass batt insulation complying with Section 707.3 of the code must be installed in the cavity of the wall.

2.1.4.3.2 Exterior Face: Any of the following substrates may be used:

- One layer of minimum $^1/_2$-inch-thick (12.7 mm) water-resistant core gypsum sheathing.
- One layer of minimum $^7/_{16}$-inch-thick (11.1 mm) oriented strand board (OSB).
- One layer of minimum $^7/_{16}$-inch-thick (11.1 mm) plywood.

The substrates must be as described in Section 2.1.2.5 or 2.1.2.9 of this report, and must be installed on the wood framing as described in Section 2.1.3.3.2 or 2.1.3.3.3, as applicable. Horizontal joints in the exterior face sheathing must be offset 24 inches (610 mm) from horizontal joints of the gypsum wallboard on the opposite wall face. A weather-resistive barrier complying with this report must be installed as described in this report. The lath and wall coating must be installed as described in this report.

2.1.5 Noncombustible Construction: When installed in accordance with Sections 2.1.5.1 through 2.1.5.6, the stucco system may be installed on exterior walls required to be of noncombustible construction.

2.1.5.1 Interior Finish: One layer of $^5/_8$-inch-thick (15.9 mm), Type X gypsum wallboard complying with ASTM C 36 is applied vertically to steel framing with all edges blocked. Fasteners are No. 8 by $1^1/_4$-inch-long (31.7 mm) buglehead screws fastened to board joints at 8 inches (203 mm) on center and to intermediate locations at 12 inches (305 mm) on center. All joints are taped and treated with joint compound. Intermediate fasteners are treated with compound.

2.1.5.2 Steel Framing: Minimum $3^5/_8$-inch-deep (92 mm), minimum No. 20 gage [0.036 inch (0.914 mm)] steel studs spaced a maximum of 16 inches (406 mm) on center.

2.1.5.3 Openings: Wall openings are framed with minimum 0.125-inch-thick (3.2 mm) tubular aluminum or steel framing.

2.1.5.4 Exterior Finish: One layer of minimum $^1/_2$-inch-thick (12.7 mm) gypsum sheathing complying with ASTM C 79 is applied horizontally to the steel framing using No. 8 by $1^1/_4$-inch-long (31.7 mm) buglehead screws spaced 8 inches (203 mm) on center at all framing locations.

2.1.5.5 Stud Cavity: At floor levels, Thermafiber insulation (ICBO ES ER-2331) is fitted into each stud cavity. The insulation has a minimum nominal density of 4 pounds per cubic foot, is 4 inches (102 mm) thick, and is approximately 6 to 8 inches (152 to 203 mm) wide. To fit within a stud cavity, it must be long enough to achieve a friction fit.

2.1.5.6 Stucco System: The stucco system includes application of one layer of Pyro-Cure 600 vapor retarder, manufactured by Fortifiber. Pyro-Cure vapor retarder has a maximum flame-spread rating of 25 and a maximum smoke-developed rating of 30, and qualifies as a Type 1, Grade A, weather-resistive barrier in accordance with UBC Standard 14-1. The vapor retarder is installed over the sheathing in accordance with Section 1402.1 of the code. One-inch-thick (25.4 mm) EPS insulation board with a nominal 1.5-pound-per-cubic-foot (24 kg/m^3) density is installed horizontally, in running bond, to the sheathing. Reinforcement consists of 1-inch (25.4 mm) by No. 20 gage, galvanized steel, self-furring, woven-wire fabric lath. The lath, insulation board, and vapor retarder are positively fastened to the steel framing using No. 8 by $2^1/_2$-inch-long (63.5 mm), wafer-head, self-drilling screws spaced at 8 inches (203 mm) on center to all framing members. The stucco is applied to a minimum $^3/_8$-inch (9.5 mm) thickness in accordance with Section 2.1.3.1 of this report.

2.1.6 Shear Wall: A shear wall providing wall bracing required by Section 2320.11.3 of the UBC may be constructed using the stucco materials described in Section 2.1.2.1. The individual shear walls must have a maximum height-to-length ratio complying with Section 2513.4 of the code. Wall framing is minimum 2-by-4 wood studs spaced 16 or 24 inches (406 or 610 mm) on center. A weather-resistive barrier must be installed in accordance with Section 2.1.2.11 of this report prior to installation of Fome-Cor Board Lathing Material. Fome-Cor Board Lathing Material recognized in ER-3335 is applied to framing with 3-inch (76 mm) horizontal weather laps and 6-inch (152 mm) vertical laps, and is spot-fastened into place. The $1^1/_2$-inch (38 mm) by No. 17 gage wire fabric lath is then applied over the Fome-Cor Board Lathing Material and fastened to all framing members at 6 inches (152 mm) on center using No. 16 gage corrosion-resistant staples having a 1-inch (25.4 mm) crown. The staple legs must be a minimum of $1^1/_4$ inches (31.7 mm) long and must be long enough to penetrate framing at least 1 inch (25.4 mm). The lath is overlapped a minimum of 3 inches (76 mm). Lath overlaps should be offset from Fome-Cor Board Lathing Material overlaps. The exterior cementitious coating base coat is a minimum of $^1/_2$ inch (12.7 mm) thick, and is cured in accordance with Section 2.1.7.3. The finish coat is minimum $^1/_8$-inch-thick (3.2 mm) exterior cementitious coating material applied after the base coat had been properly cured in accordance with Section 2.1.7.3. The allowable racking shear is 170 plf (2482 N/m).

2.1.7 Miscellaneous:

2.1.7.1 Inspection Requirements: Building department inspection is required on wire lath installation prior to application of the coating, as noted in Section 108.5.5 of the UBC.

2.1.7.2 Control Joints: Control joints must be installed as specified by the architect, designer, builder or exterior coating manufacturer, in that order. In the absence of other details, conventional three-coat plastering details must be used.

2.1.7.3 Curing: Moist curing must be provided for 48 hours after coating application.

2.1.7.4 Soffits: The system may be applied to soffits, provided the coating is applied over metal lath complying with Table 25-B of the UBC in lieu of applying the coating over wire fabric lath. Metal lath fastening must comply with Table 25-C, except the length of the fastener must be increased by the thickness of any substrate.

2.1.7.5 Sills: The system may be applied to sills at locations such as windows and other similar areas. Sills with depths of 6 inches (152 mm) or less may have the coating and lath applied to any substrate permitted in this report, provided the coating, lath, weather-resistive barrier and substrate are installed in accordance with the appropriate section of this report. Sills with depths exceeding 6 inches (152 mm) must have substrates of solid wood or plywood. The substrate is fastened in accordance with Table 23-II-B-1 of the UBC, and over the substrate a double layer of a code-complying Grade D weather-resistive barrier is applied. The coating, lath, and optional EPS board are applied in accordance with Section 2.1.3.2 of this report.

2.2 Exterior Cement Plaster:

2.2.1 General: The Western 1-Kote Stucco, OCS, Stucco Plus Concentrate and Sto Powerwall Stucco stucco mixes described in Section 2.1.2.1 can be used as exterior cement plaster applied directly to concrete or masonry walls. The same stucco mixes can also be used as the first and second coats of exterior cement plaster of wood or steel frame construction, not required to be of fire-resistive construction, provided application is in accordance with UBC Section 2508.

2.2.2 Installation:

2.2.2.1 Concrete and Masonry Substrates: The concrete or masonry surface must be prepared in accordance with Section 2508.8 of the UBC. The application of the stucco mix must be in accordance with Table 25-D of the UBC and Section 2.1.3.1 of this report.

2.2.2.2 Wood or Steel Stud Wall Framing: Lath, weather-resistive barrier and plaster must be installed as described in Section 2508 of the UBC.

2.3 Identification:

The factory-prepared mix is delivered to the jobsite in water-resistant bags that have labels bearing the following information:

1. The name and address of Western Stucco Products Co., Inc.; or the name and address of one of the additional listees noted in this report and the logo of Western Stucco Products Co., Inc.
2. The evaluation report number (ICBO ES ER-3899).
3. Identification of components.
4. Weight of packaged mix.
5. Storage instructions.
6. Maximum amount of water and other components that may be added, and conditions that must be considered in determining actual amounts.
7. Curing instructions.

Polystyrene foam plastic insulation boards and Fome-Cor Board Lathing Material are identified in accordance with their respective ICBO ES evaluation reports. Additionally, the board density must be noted.

07245

For insulation boards applied to walls required to be of noncombustible construction, as noted in Section 2.1.5, each board must be identified along one edge, and one board from each insulation package must be identified on both faces, with the evaluation report number (ICBO ES ER-3899), the system name as stated in Table 1 of this report, and the ICBO ES evaluation report number for the foam plastic.

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICBO ES Acceptance Criteria for Cementitious Exterior Wall Coatings (AC11), dated January 2001, and reports of tests in accordance with UBC Standards 26-4 and 7-1.

4.0 FINDINGS

That the exterior cementitious stucco wall coating systems and exterior cement plasters described in this report comply with the 1997 *Uniform Building Code*™ (UBC), subject to the following conditions:

4.1 The materials and methods of installation comply with this report and the manufacturer's instructions.

4.2 Installation is by contractors approved by the manufacturer.

4.3 The system is applied to walls required to be of noncombustible construction, in accordance with Section 2.1.5.

4.4 The axial load applied to the fire-resistive wall assemblies described in Sections 2.1.4.2 and 2.1.4.3 does not exceed the least of the following:

4.4.1 1,100 pounds (4895 N) per stud

4.4.2 Design stress, based on 0.78 F'_c, in accordance with Chapter 23, Division III, of the UBC.

4.4.3 Design stress of 0.78 F'_c at a maximum l_e/d ratio of 33.

4.4.4 For the assembly described in Section 2.1.4.2, 54 percent of the load calculated in accordance with Chapter 23, Division III, of the UBC.

4.4.5 For the assembly described in Section 2.1.4.3, 44.7 percent of the load calculated in accordance with Chapter 23, Division III, of the UBC.

4.5 The axial load design stress for the fire-resistive wall assembly described in Section 2.1.4.1 is limited to 0.78 F'_c, and the maximum stress does not exceed 0.78 $F'c$ at a maximum l_e/d ratio of 33.

4.6 The interior of the building is separated from the foam plastic boards by a thermal barrier complying with Section 2602.4 of the code, such as $^1/_2$-inch-thick (12.7 mm) regular gypsum wallboard applied in accordance with Table 25-G of the UBC.

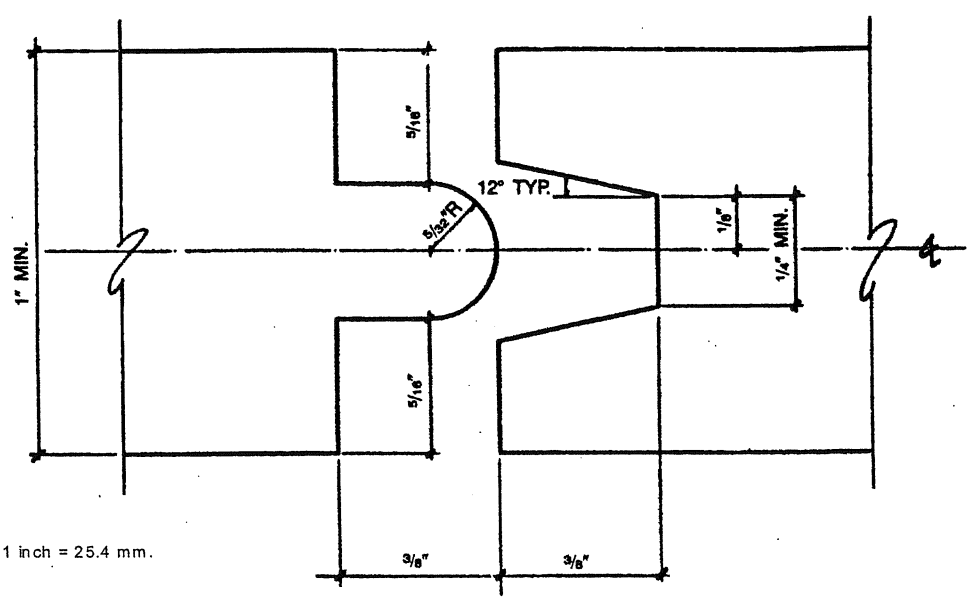
4.7 An installation card, such as shown in Figure 3, is completed and left at the jobsite for the owner, and a copy is filed with the building department.

4.8 The allowable wind load on the cementitious one-coat stucco systems with studs a maximum of 24 inches (610 mm) on center is 35 psf (1.68 kN/m²), except for gypsum sheathing substrates, for which the allowable wind load is 25 psf (1.20 kN/m²). Support framing must be adequate to resist the design load.

This report is subject to re-examination in two years.

TABLE 1—CROSS REFERENCE INDEX

COMPANY NAME	SYSTEM NAME	PRODUCT NAME
Western Stucco Products, Inc.	Western 1-Kote Exterior Stucco System	Western 1-Kote
Dryvit Systems, Inc.	Dryvit Stucco Plus System	Stucco Plus Concentrate
Sto Corp.	Sto One-coat Stucco System	Sto One-coat Stucco
Mater Wall Inc.	Master Wall One Coat Stucco System	OCS



For SI: 1 inch = 25.4 mm.

FIGURE 1—TONGUE AND GROOVE

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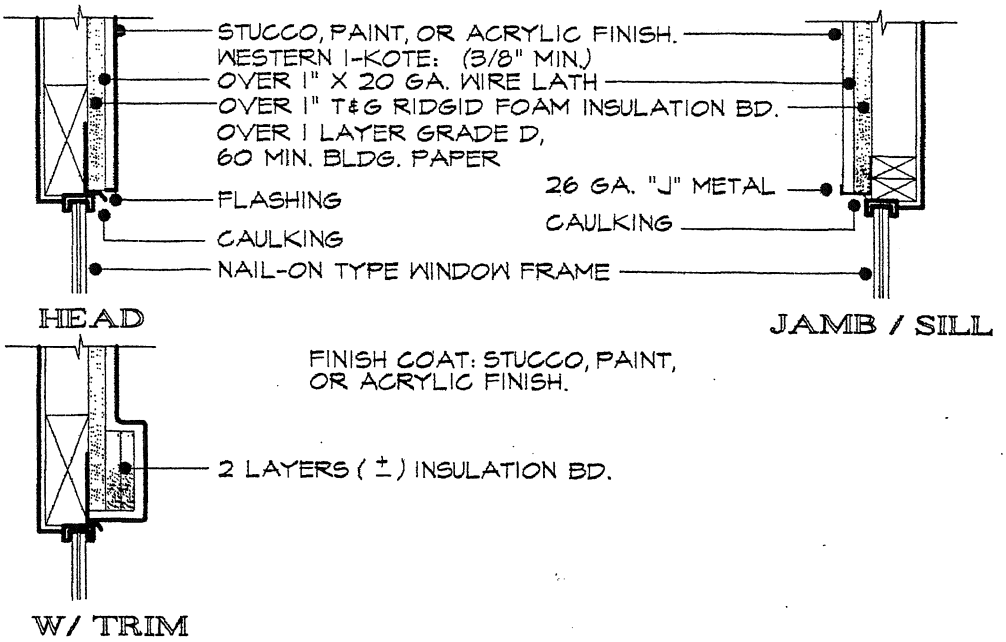
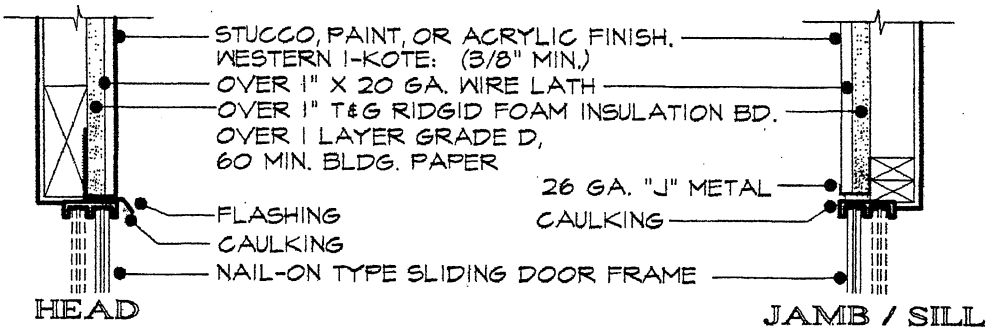
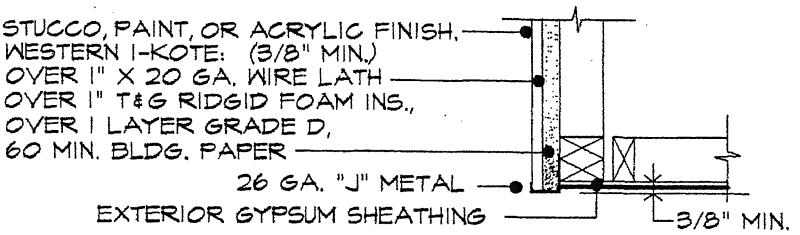


WINDOWS



SLIDING GLASS DOORS



WOOD SOFFIT

For **SI:** 1 inch = 25.4 mm.

FIGURE 2—TYPICAL INSTALLATION DETAILS

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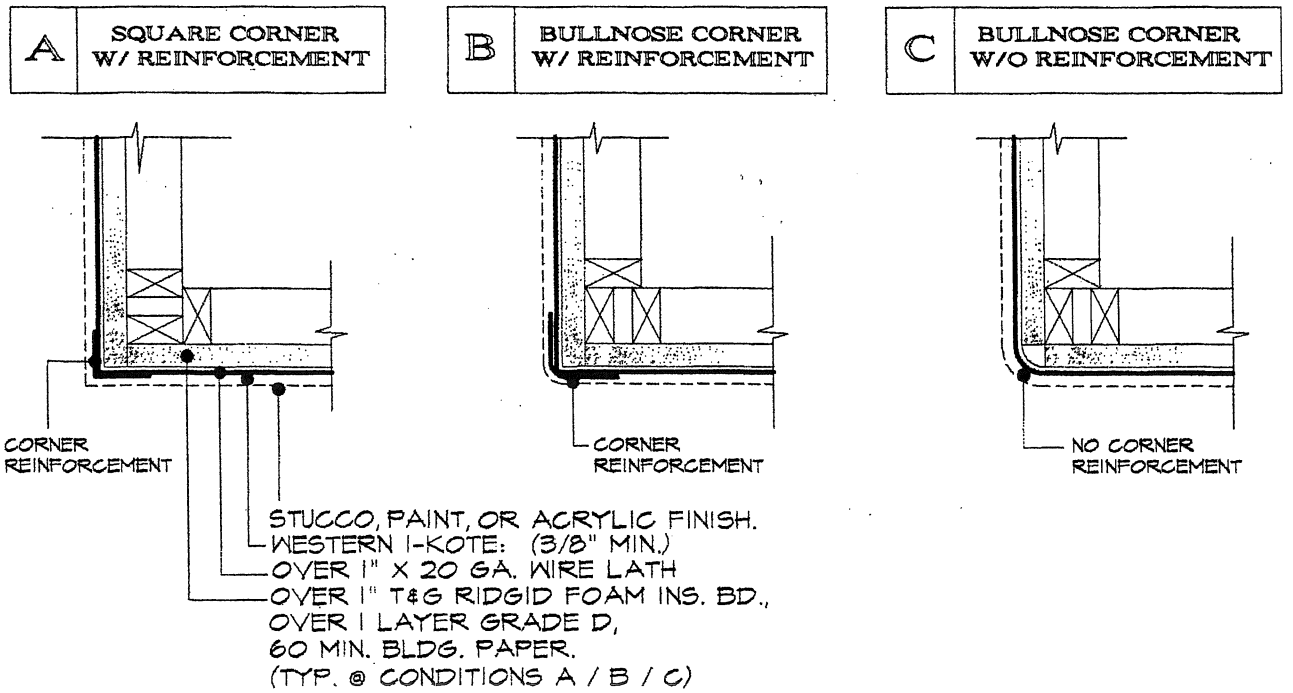

For SI: 1 inch = 25.4 mm.

FIGURE 2—TYPICAL INSTALLATION DETAILS—(Continued)

INSTALLATION CARD

(Coating system Trade Name)
(Name of coating manufacturer)

Job Address

_____

_____

_____

ICBO Evaluation Service, Inc., Evaluation Report ER-_____

Date of Job Completion_____

Plastering Contractor

Name: _____

Address: _____

Telephone No.: ( ) _____

Approved contractor number as issued by coating manufacturer: _____

This is to certify that the exterior coating system on the building exterior at the above address has been installed in accordance with the evaluation report specified above and the manufacturer's instructions.

_____ _____
Signature of authorized representative or plastering contractor — Date

This installation card must be presented to the building inspector after completion of work and before final inspection.

FIGURE 3

SECTION 07540 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Mechanically fastened and Adhered membrane roofing system.
2. Roof insulation.

B. This Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 5 Section "Steel Deck."

C. Related Sections include the following:

1. Division 5 Section "Steel Deck" for furnishing acoustical deck rib insulation.
2. Division 6 Section "**Rough Carpentry**]" for wood nailers, curbs, and blocking .
3. Division 7 Section "Building Insulation" for insulation beneath the roof deck.
4. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
6. Division 7 Section "Joint Sealants."
7. Division 15 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.

C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-[**90**]
2. Hail Resistance: **SH**.

D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems."

1. Corner Design Uplift Pressure: 45 lbf/sq. ft. (kPa/sq. m).
2. Perimeter Design Uplift Pressure: 45 lbf/sq. ft. (kPa/sq. m).
3. Field-of-Roof Design Uplift Pressure: 45 lbf/sq. ft. (kPa/sq. m).
4. Safety Factor: 2

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns.

C. Samples for Verification: For the following products:

1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
3. 12-by-12-inch (300-by-300-mm) square of walkway pads or rolls.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1. Provide time for State review of the roofing system at the pre-installation conference and during installation and as a sign-off once the system is fully installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has [**UL listing**] & [**FMG approval**] for membrane roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain components for membrane roofing system from approved roofing membrane manufacturer.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class [**A**] ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, walkway products and other components of membrane roofing system.
2. Warranty Period: [**20**] years from date of Substantial Completion.
3. See the DFCM form – Single Ply Roofing Warranty at www.dfcm.state.ut.us – construction management.

B. Contractor Roofing Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: [**Five**] years from date of Substantial Completion.
2. See the DFCM form – Contractor Roofing Warreanty at www.dfcm.state.ut.us – construction management.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:

1. Available Manufacturers:

a. Carlisle SynTec Incorporated.
b. Firestone Building Products Company.

c. GAF Materials Corporation.
d. GenFlex Roofing Systems.
e. Johns Manville International, Inc.
f. Sarnafil Inc.
g. Stevens Roofing Systems; Div. of JPS Elastomerics.
h. Versico Inc.

2. Thickness: [**60 mils (1.5 mm)**] nominal.
3. Exposed Face Color: light **Gray** or **White**
4. Physical Properties:

a. Breaking Strength: 225 lbf (1 kN); ASTM D 751, grab method.
b. Elongation at Break: 25 percent; ASTM D 751.
c. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
d. Brittleness Point: Minus -40 deg F .
e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 573.
g. Water Absorption: Less than 4 percent max. mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
h. Linear Dimension Change: Plus or minus 1 percent; ASTM D 1204.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

C. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 60 mils thick, minimum, of same color as sheet membrane.

D. Bonding Adhesive: Manufacturer's standard **solvent** based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Epanded-Polystyrene Board Insulation: ASTM C 578, Type [**III, 1.25-lb/cu. ft. minimum** density, square edged.

1. [**Available**]Manufacturers:

a. DiversiFoam Products.
b. Dow Chemical Company.
c. Owens Corning.
d. Tenneco Building Products.
e. or pre-approved equal

C. Molded-Polystyrene Board Insulation: ASTM C 578 Type [**III, 1.25-lb/cu. ft.** minimum density.

1. [**Available**]Manufacturers:

a. Manufacturers with a third-party certification program satisfying model building code mandatory requirements for foam plastics[**and that produce FMG-approved molded polystyrene**].

.

D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of [**1/4 inch per 12 inches (1:48)**] unless otherwise indicated.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

F. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, [**1/4 inch (6 mm)**] thick.

1. Product: Subject to compliance with requirements, provide "Dens-Deck" by Georgia-Pacific Corporation.

G. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.

H. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of 0.031 inch (0.8 mm) thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

2.12 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway [**pads or rolls**], approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Install acoustical roof deck rib insulation strips, specified in Division 5 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is [**1-1/2 inches (38 mm)**] or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Loosely Laid Insulation: Loosely lay insulation units.

H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
3. Set each layer of insulation in a cold fluid-applied adhesive.

I. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

1. Install sheet according to ASTM D 5036.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Bonding Adhesive: Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

F. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer and install fabric-backed roofing membrane. Do not apply roofing asphalt to splice area of roofing membrane.

G. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

H. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

I. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

J. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

K. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.7 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

1. Install sheet according to ASTM D 5082.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

I. Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings[**and mechanically anchor to substrate through termination bars**].

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.12 ROOFING INSTALLATION REQUIREMENTS BY DFCM

A. Verify the latest State requirements for this type of roofing at www.dfcm.state.ut.us – construction management window.

END OF SECTION 07540

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Manufactured reglets.
3. Formed roof drainage system.
4. Formed low-slope roof flashing and trim.
5. Formed wall flashing and trim.
6. Formed equipment support flashing.
7. Formed overhead-piping safety pans.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
2. Division 5 Section "Architectural Joint Systems" for manufactured sheet metal expansion-joint covers.
3. Division 6 Section "Rough Carpentry " for wood nailers, curbs, and blocking.
4. Division 7 Section "TPO Membrane Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
5. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
6. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a

result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: Standard one-side bright.
2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

   a. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft..

2.4 MISCELLANEOUS MATERIALS

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.
1. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
2. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.

1. Available Manufacturers:

   a. Cheney Flashing Company, Inc.
   b. Fry Reglet Corporation.
   c. Heckmann Building Products Inc.
   d. Hickman, W. P. Company.
   e. Keystone Flashing Company, Inc.
   f. Sandell Manufacturing Company, Inc.

2. Material: Aluminum, 0.024 inch thick.
3. 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.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 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, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: 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.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Gutter Style: As selected by Architect.
2. Expansion Joints: Lap type.
3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
4. Gutters with Girth up to 15 Inches: Fabricate from the following material:

   a. Aluminum: 0.0320 inch thick.

5. Gutters with Girth 16 to 20 Inches: Fabricate from the following material:

   a. Aluminum: 0.040 inch thick.

6. Gutters with Girth 21 to 25 Inches: Fabricate from the following material:
   a. Aluminum: 0.050 inch thick.

7. Gutters with Girth 26 to 30 Inches: Fabricate from the following material:
   a. Aluminum: 0.063 inch thick.

B. Built-in Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch- long sections. Fabricate expansion joints and accessories from same metal as gutters, unless otherwise indicated.

1. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
2. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
3. Fabricate built-in gutters from the following material:

a. Stainless Steel: 0.0156 inch thick.

C. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Manufactured Hanger Style: As selected by Architect.
2. Fabricate downspouts from the following material:

a. Aluminum: 0.024 inch thick.

D. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

1. Fabricate parapet scuppers from the following material:

a. Aluminum: 0.0320 inch thick.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows.

1. Fabricate conductor heads from the following material:

a. Aluminum: 0.0320 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide joint cover plates.

1. Joint Style: Lap, 4 inches wide.
2. Fabricate with scuppers spaced 10 feet apart, of dimensions required with 4-inch- wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate scuppers from the following material:
   a. Aluminum: 0.050 inch thick.

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch- wide concealed backup plate.
2. Fabricate copings from the following material:
   a. Aluminum: 0.050 inch thick.

C. Base Flashing: Fabricate from the following material:
1. Aluminum: 0.040 inch thick.

D. Counterflashing: Fabricate from the following material:
1. Aluminum: 0.0320 inch thick.

E. Flashing Receivers: Fabricate from the following material:

1. Aluminum: 0.0320 inch thick.

F. Roof-Penetration Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
3. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.
4. Zinc: 0.040 inch thick.

G. Splash Pans: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft.**]
2. Lead-Coated Copper: [**17.2 oz./sq. ft.**]
3. Aluminum: [**0.040 inch**thick.

H. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: [**4.0 lb/sq. ft.**] hard tempered.
2. Stainless Steel: [**0.0156 inch**] thick.
3. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch**] thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high end dams. Fabricate from the following material:
1. Stainless Steel: 0.0156 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.
3. Zinc: 0.040 inch thick.

B. Openings Flashing in Frame Construction: Fabricate head, sill, and similar flashings to extend 1 inch beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:

1. Aluminum: [**0.0320 inch**] thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch thick.
3. Galvanized Steel: 0.0276 inch thick.
4. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
5. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Stainless Steel: 0.0250 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.0250 inch thick.
3. Galvanized Steel: 0.0396 inch thick.
4. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work 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 system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

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 fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. 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.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. 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 or bayonet-type 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 elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper Use copper or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant 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 ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either 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 in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Pretinning is not required for zinc-tin alloy-coated stainless steel and lead.
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored

gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
5. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
6. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
7. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Built-in Gutters: Join sections with riveted and soldered or lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.

1. Install felt underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails. Install slip sheet over felt underlayment.
2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
4. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Connect downspouts to underground drainage system indicated.

E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

H. Splash Pans: Install where downspouts discharge on low-sloped roofs. Set in asphalt roofing cement or elastomeric sealant compatible with roofing membrane.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual."

Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 20-inch centers.

D. 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.

E. 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 [**elastomeric**] [**butyl**] sealant.

1. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of manufactured or formed through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies and Stone Veneer Assemblies."

C. Reglets: Installation of reglets is specified in Division 3 Section "Cast-in-Place Concrete and Division 4 Section "Unit Masonry Assemblies."

D. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 1 inch beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. 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.

3.7 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 and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. 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 07620

SECTION 07720 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof hatch.

B. Related Sections include the following:

   1. Division 5 Section "Metal Fabrications" for ladders and miscellaneous metal framing and supports.
   2. Division 6 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
   3. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, fasciae, roof expansion-joint covers, valleys, and miscellaneous sheet metal trim and accessories.
   4. Division 7 Sections for roofing accessories included as part of roofing Work.
   5. Division 15 Section "Power Ventilators" for power roof-mounted ventilators.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for roof accessories with factory-applied color finishes.

1.4 QUALITY ASSURANCE

A. Standards: Comply with the following:

   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. As Indicated on Drawings or Bilco or pre-approved equal.

2.2 MATERIALS, GENERAL

A. Galvanized Steel Sheet: ASTM A 653/A 653M with G90 coating designation; commercial quality, unless otherwise indicated.

B. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

C. Security Grilles: 3/4-inch- diameter, hardened steel bars spaced 6 inches o.c. in one direction and 12 inches o.c. in the other. Weld bar intersections and ends of bars to structural frame or primary curb walls. Clean and paint with rust-inhibitive metal primer.

D. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

   1. Where removing exterior exposed fasteners affords access to building, provide nonremovable fastener heads.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

F. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

H. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

I. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 ROOF HATCHES

A. General: Fabricate units to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loading pressure. Frame with minimum 9-inch- high, integral-curb, double-wall construction with 1-1/2-inch insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1- inch- thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.

B. Type: Single-leaf personnel access.

   1. For Ladder Access: 30 by 36 inches.

C. Material: Galvanized steel sheets.

1. Finish: Baked enamel.

D. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per foot, fabricate hatch curbs with height tapered to match slope to level tops of units.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

G. Update installation..

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07720

SECTION 07811 - SPRAYED FIRE-RESISTIVE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sprayed fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.
B. This Section includes sprayed fire-resistive materials applied to surfaces that are exposed to view when the Work is completed.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show extent of sprayed fire-resistive material for each construction and fire-resistance rating, applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction, and minimum thicknesses.

C. Compatibility and adhesion test reports.

D. Product test reports.

E. Research/evaluation reports.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Sprayed Fire-Resistive Materials Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

C. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to prepare compatibility and adhesion test reports.

1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.

D. Fire-Test-Response Characteristics: Where indicated, provide products identical to those tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Identify products with appropriate markings of applicable testing and inspecting agency.

E. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

F. Mockups: Apply mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Apply mockup [**of 100 sq. ft. (9 sq. m) for each product indicated**]
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference [**at Project site**]

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is [**40 deg F (4 deg C)**] or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

C. Sequence and coordinate application of sprayed fire-resistive materials with related work.

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.

2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, tested and corrections have been made to defective applications.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within [**two**] years from date of Substantial Completion.

1. Failures include, but are not limited to, cracking, flaking, spalling, eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel and other causes not reasonably foreseeable under conditions of normal use.

PART 2 - PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

C. Products: Subject to compliance with requirements, provide one of the following:

1. Cementitious Sprayed Fire-Resistive Material:

a. Carboline Co., Fireproofing Products Div.; Pyrolite 15.

b. Carboline Co., Fireproofing Products Div.; Pyrolite 15 High Yield.
c. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type MK-6s.
d. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type MK-6/HY.
e. Isolatek International Corp., Cafco Products; Cafco 300.
f. Southwest Vermiculite Co., Inc.; 5EF.
g. Southwest Vermiculite Co., Inc.; 5GP.
h. or pre-approved equal

2. Sprayed-Fiber Fire-Resistive Material:

a. Isolatek International Corp., Cafco Products; Cafco Blaze-Shield II.
b. Isolatek International Corp., Cafco Products; Type JN-HD.
c. or pre-approved equal

D. Material Composition: **As follows**:

1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
2. Sprayed-fiber fire-resistive material consisting of factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.

E. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb/cu. ft. (240 kg/cu. m) for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:

a. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch (6 mm).
b. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.
c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m).

3. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 under the following conditions:

   a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
   b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.
   c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch (19 mm).

4. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified, but not less than 15 lb/cu. ft. (240 kg/cu. m).
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of [**0.025 g/sq. ft. (0.270 g/sq. m)**] in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

   a. Flame-Spread Index: meet minimum as required by building department.
   b. Smoke-Developed Index: meet minimum as required by building department.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.2 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

   1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.

2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International Corp.; Cafco Products.

F. Topcoat: Type recommended in writing by manufacturer of each sprayed fire-resistive material for application over concealed sprayed fire-resistive materials.

2.3 EXPOSED SPRAYED FIREPROOFING MATERIAL

A. For exposed fireproofing material meet requirements under 2.1 above. In addition to requirements under 2.1. above, additionally provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated that will encapsulate (Topcoat protection) or otherwise provide for resistance to fireproofing being easily knocked loose. Or, provide other means and materials to accomplish the resistance to accidental damage caused by incidental bumping or hitting of the material selected as required by codes and as acceptable to the local jurisdiction. Located on the bottom of flange and edges only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, to determine whether they are in satisfactory condition to receive sprayed fire-resistive material and to verify the following:

1. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.

C. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of oil, rolling compounds, and other substances capable of interfering with bond.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

F. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

G. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.

H. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.

I. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

J. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

K. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed Sprayed Fire-Resistive Materials" Article.

L. Apply water overspray to sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating.

M. Apply sealer to sprayed fire-resistive material

N. Apply topcoat to sprayed fire-resistive material].

O. Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

P. Repair or replace work that has not been successfully protected.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of completed applications of sprayed fire-resistive material shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.
2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
5. If testing finds applications of sprayed fire-resistive material are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

C. Remove and replace applications of sprayed fire-resistive material where test results indicate that it does not comply with specified requirements for cohesion and adhesion, for density, or for both.

D. Apply additional sprayed fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 07811

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:

1. Floors.
2. Roofs.
3. Walls and partitions.
4. Smoke barriers.
5. Construction enclosing compartmentalized areas.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for construction of openings in concrete slabs and walls.
2. Division 7 Section "Building Insulation" for safing insulation and accessories.
3. Division 7 Section "Sprayed Fire-Resistive Materials."
4. Division 15 Sections specifying duct and piping penetrations.
5. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.

2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Submit and obtain approvals from building department having jurisdiction over the project for each type of through penetration firestop system prior to installation.
3. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:.

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

1) UL in "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. DAP Inc.
2. Firestop Systems Inc.
3. Hilti Construction Chemicals, Inc.
4. International Protective Coatings Corp.
5. Isolatek International.
6. Nelson Firestop Products.
7. 3M Fire Protection Products.
8. United States Gypsum Company.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.

1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:

B. This Section includes sealants for the following applications:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

   a. Control and expansion joints in cast-in-place concrete.
   b. Joints in exterior insulation and finish systems.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors and windows.

2. Exterior joints in the following horizontal traffic surfaces:
   a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
   b. Joints between different materials listed above.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Tile control and expansion joints.
   d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
   f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   g. Other joints as indicated.

C. Related Sections include the following:

1. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
2. Division 7 Section "Firestopping" for fire-resistant building joint-sealant systems.
3. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants by hand-pull method described below:

    a. Install joint sealants in 60-inch- long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
    b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
    c. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

6. Report whether 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. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
7. Evaluation of Preconstruction Field-Adhesion-Test Results: 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 substrates during testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

   1. Warranty Period: Two years from date of Substantial Completion.

C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

   1. Warranty Period: 20 years from date of Substantial Completion.

D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Continuous-Immersion-Test-Response Characteristics: Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.

1. One additional four-week immersion period.

E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Concealed Joints: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.
    b. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. 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 that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    1. Do not leave gaps between ends of sealant backings.
    2. Do not stretch, twist, puncture, or tear sealant backings.
    3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

    1. Place sealants so they directly contact and fully wet joint substrates.
    2. Completely fill recesses provided for each joint configuration.
    3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

    1. Remove excess sealants from surfaces adjacent to joint.
    2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

   a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants by hand-pull method described below:

   a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
   b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
   c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
4. Inspect tested joints and report on the following:

   a. Whether sealants in joints 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. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
   b. Whether sealants filled joint cavities and are free from voids.
   c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.7 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Manufacturers and Sealant Types:

Sealant Type	Joint Type/Interface	Description	Representative Manufacturer	Manufacturer Number/Name	Color
Butyl	General use in concealed static joints, bedding of sills, etc.	Single-component, gun grade, nonsag	Pecora	BC-158	Black
Acrylic	Exposed interior static joints	Single-component, gun grade, nonsag	Pecora	AC-20+	TBD
Polyurethane	Exposed exterior static and dynamic joints	Single-component, gun grade, nonsag	Pecora	Dynatrol 1	TBD
Self-Leveling Polyurethane	Exposed horizontal concrete-to-concrete joints that are traffic bearing	Single-component, moisture curing, traffic grade	Pecora	UREXPAN #201	TBD
Fire Rated	Penetrations at fire-rated assemblies	Refer to Section 07840			
Acoustical	Acoustically-rated construction	Refer to Section 09820			

B. Glazing Sealants: As specified in Section 08800, "Glazing."

C. Additional Sealant Materials: As specified in the respective Specification Sections.

3.8 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Sealant Backer Rod: Compressible rod-stock polyethylene foam, nongassing, polyethylene-jacketed polyurethane foam, butyl-rubber foam, neoprene foam, or other flexible, permanent, durable, nonabsorptive closed cell material as recommended for compatibility with sealant by sealant manufacturer.

C. Cleaner for Nonporous Surfaces: Provide nonstaining chemical cleaner or type acceptable to manufacturer of sealer and backing materials which is not harmful to substrates and adjacent nonporous materials.

D. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer. Provide self-adhesive tape where applicable.

F. Paving Joint Backing: Preformed, self-expanding cork complying with ASTM D1752, Type III, or as recommended by paving sealant manufacturer.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel doors.
2. Steel door frames.
3. Sidelight frames
4. Fire-rated door and frame assemblies.
5. Fire-rated window frames.
6. Louvers in doors.

B. Related Sections include the following:

1. Division 5 Section "Formed-Metal Fabrications" for customized hollow-metal work other than doors, panels, and frames.
2. Division 8 Section "Door Hardware (Scheduled by Naming Products)" for door hardware and weather stripping.
3. Division 8 Section "Glazing" for glass in glazed openings in doors and frames.
4. Division 9 Section "Gypsum Board Assemblies" for spot-grouting frames installed in steel-framed gypsum board partitions.
5. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.

6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Curries Company; P.O. Box 1648 525 Ninth St. SE, Mason City, Iowa 50401

2. Kewanee Corporation; 1642 Burlington Ave., Kewanee, Il 61443

3. Steelcraft-A Division of Ingersoll-Rand; 9017 Blue Ash Rd., Cincinnati, Ohio 45242

2.2 MATERIALS

A. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model 2 (Seamless).

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.042-inch- thick steel sheet for:

1. Level 1 steel doors.
2. Wood doors where indicated.

C. Frames of 0.053-inch- thick steel sheet for:

1. Door openings wider than 48 inches.
2. Level 1 steel doors.
3. Level 2 steel doors.

D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

E. Plaster Guards: Provide 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

F. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

G. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, 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.

B. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:
   1. Polyurethane.
   2. Rigid mineral-fiber board.

C. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

D. Clearances for Fire-Rated Doors: As required by NFPA 80.

E. Single-Acting, Door-Edge Profile: Beveled edge, unless square edge is indicated.

F. Double-Acting, Door-Edge Profile: Round vertical edges with 2-1/8-inch radius.

G. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

H. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

I. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

J. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

   1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

K. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413.

   1. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 51 or better.

L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

   1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

M. Frame Construction: Fabricate frames to shape shown.

   1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
   2. Provide welded frames with temporary spreader bars.
   3. Provide terminated stops where indicated.

N. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

O. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

P. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

B. All final finishes by Interior Designer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. Install fire-rated frames according to NFPA 80.
5. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Hollow-core doors with wood-veneer faces.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Louvers for flush wood doors.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry or Interior Architectural Woodwork" for wood door frames.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
2. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Exterior Doors: Two years.
b. Solid-Core Interior Doors: Life of installation.
c. Hollow-Core Interior Doors: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.
b. Ampco Products, Inc.

c. Buell Door Company.
d. Chappell Door Co.
e. Eagle Plywood & Door Manufacturing, Inc.
f. Eggers Industries; Architectural Door Division.
g. GRAHAM Manufacturing Corp.
h. Haley Brothers, Inc.
i. Ideal Wood Products, Inc.
j. IPIK Door Company.
k. Lambton Doors.
l. Marlite.
m. Mohawk Flush Doors, Inc.
n. Oshkosh Architectural Door Co.
o. Poncraft Door Co.
p. Southwood Door Co.
q. Vancouver Door Company, Inc.
r. VT Industries Inc.
s. Weyerhaeuser Company..

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Premium, with Grade AA faces.
2. Species and Cut: White birch, rotary cut.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 10 feet or more.

7. Stiles: Same species as faces.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-1.

2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Exterior Doors:

1. Core: Either glued block or structural composite lumber.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Interior Veneer-Faced Doors:

1. Core: Either glued block or structural composite lumber.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

D. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.

2.4 HOLLOW-CORE DOORS

A. Interior Veneer-Faced Doors:

1. Core: Standard hollow core.
2. Construction: Seven plies.
3. Blocking: Provide wood blocking with minimum dimensions as follows:

a. 5-by-18-inch lock blocks [**at both stiles**].
b. 5-inch top- [**and bottom-**]rail blocking.
c. 10-inch [**top- and**] bottom-rail blocking.
d. 2-1/2-inch midrail blocking.

2.5 LOUVERS AND LIGHT FRAMES

A. Wood Louvers: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.

B. Metal Louvers:

1. Blade Type: Vision-proof, inverted V.
2. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

C. Fire Door Louvers: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.

1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

D. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

E. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch-thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated.

F. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.6 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. 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 factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors: Factory treat exterior doors with water repellent after manufacturing has been completed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.

    a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-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.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

F. Field-Finished Doors: Refer to the following for finishing requirements:

1. Division 9 Section "Painting and Exterior Wood Stains."

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 08311 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall access doors and frames.
2. Fire-rated wall access doors and frames.
3. Ceiling access doors and frames.
4. Fire-rated ceiling access doors and frames.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 7 Section "Roof Accessories" for roof hatches.
3. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
4. Division 9 Section "Acoustical Tile Ceilings" for access tile in suspended acoustical tile ceilings.
5. Division 15 Section "Duct Accessories" for heating and air-conditioning duct access doors.
6. Division 15 Section "Storm Drainage Piping" for connection of floor door drainage couplings to drains.

1.3 SUBMITTALS

A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:

1. Method of attaching door frames to surrounding construction.
2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that

are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors.
2. UBC Standard 7.1 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Access Doors:

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

C. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy 5005-H15; with minimum thickness indicated representing specified thickness according to ANSI H35.2.

D. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

E. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.4 ACCESS DOORS AND FRAMES TYPES:

A. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall surfaces.

2. Fire-Resistance Rating: One and one-half hour.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead.
6. Hinges: Concealed pin type.
7. Automatic Closer: Spring type.
8. Latch: Self-latching bolt operated by key with interior release.
9. Lock: Key-operated cylinder lock with interior release.

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver-operated cam latch.
6. Lock: Key-operated cylinder lock.

C. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver-operated cam latch.
6. Lock: Key-operated cylinder lock.

2.5 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
4. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
3. For doors with latches released by and locks operated by mortise cylinders, prepare access doors for cylinders specified in Division 8 Section "Door Hardware."

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.7 STEEL FINISHES

A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 SCHEDULE OF ACCESS DOORS:

A. Provide 18”x18” Type ‘C’ wall mount NR access doors at all Jacuzzi Tubs for motor access.

B. Provide 24”x24” Type ‘B’ NR ceiling mount access doors at Dryer Booster Fans for fan access.

C. Provide 18”x18” Type ‘A’ FR access doors at rated ceilings for access to Fire Rated Mechanical Dampers for reset and testing access.

D. Provide 18 X 18 type ‘A’ FR access doors at rated ceilings for access to Electrical Junction Boxes, pull boxes, cable trays, etc. as required by code.

END OF SECTION 08311

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of **manually** operated overhead coiling doors:

1. Service doors.

B. See Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of [**20 lbf/sq. ft. (960 Pa)**], acting inward and outward.
2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.

   a. Level of Protection: **Basic Protection**.
   b. Wind Zone V3 9**0mph (176 km/h)**] pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than **10,000** cycles.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.

C. Samples: For each exposed finish.

D. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpine Overhead Doors, Inc.
2. Atlas Door; Div. of Clopay Building Products Company, Inc.
3. Cookson Company.
4. Cornell Iron Works Inc.
5. Dynamic Closures Corporation.
6. Mahon Door Corporation.
7. McKeon Rolling Steel Door Company, Inc.
8. Metro Door.
9. Overhead Door Corp.
10. Pacific Rolling Doors Co.
11. Raynor.
12. Southwestern Steel Rolling Door Co.
13. Wayne-Dalton Corp (Specification based on the following door):
    a. Face-of –wall Mounting
    b. Chain hoist operation, model SDF2
    c. 900 series door
14. Windsor Door, a MAGNATRAX Corporation.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Interlocking slats in a continuous length for width of door of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door.

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
2. Slat type: **Curved**

B. Endlocks [**and Windlocks**]: Malleable-iron casings, secured to curtain slats to comply with wind load.

C. Bottom Bar: **2 equal galvanized steel angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick** to suit type of curtain slats.

1. Astragal: Replaceable, adjustable, continuous, compressible gasket of neoprene; as a cushion bumper for interior door.

D. Curtain Jamb Guides: Rolled-formed galvanized steel channels and angles (three angle assembly) of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide

adjustment. Provide removable stops on guides to prevent overtravel of curtain**, and a continuous bar for holding windlocks** and removable bottom bar stops.

E. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Steel Door Hoods: Minimum 0.028-inch- (0.7-mm-) thick, hot-dip galvanized steel sheet that matches slat steel.
2. .

F. Integral Sills: Integral part of frame assembly; fabricate of same sheet metal.

G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of hood.

1. Jamb Seals: Replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

H. Push/Pull Handles: Galvanized steel lifting handles on each side of door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

I. Slide Bolt: Engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side suitable for padlocks by Owner.

J. Chain Lock Keeper: Suitable for padlock.

K. Counterbalancing Mechanism: Adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

1. Mounting Brackets: Cast iron or cold-rolled steel plate.

L. Manual Door Operator: **Chain hoist**.

2.3 FINISHES

A. Galvanized Steel Finish: **Manufacturer's standard** finish.

1. Color and Gloss: **As selected by Architect from manufacturer's full range color and gloss**.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports

1. Install fire-rated doors to comply with NFPA 80.

B. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion, and with weathertight fit around entire perimeter.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain doors. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 083323

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

   a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.
3. Exterior and interior aluminum doorframes.

B. Related Sections include the following:

1. Division 7 Section "Building Insulation" for insulation materials field installed with aluminum-framed systems.
2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
4. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.
5. Division 10 Section "Louvers and Vents" for units installed with aluminum-framed systems.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

   a. Deflection exceeding specified limits.
   b. Thermal stresses transferred to building structure.
   c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.
   f. Sealant failure.
   g. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

   a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
   b. Test Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
   c. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1. Maximum Water Leakage: According to AAMA 501.1. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

I. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

J. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having minimum STC 32 according to ASTM E 413 and an OITC 26 according to ASTM E 1332, as determined by testing according to ASTM E 90.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

F. Field quality-control test and inspection reports.

G. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).", ICC/ANSI A117.1. FED-STD-795, and "Uniform Federal Accessibility Standards."

E. Structural-Sealant Glazing: Comply with recommendations in ASTM C 1401, "Guide for Structural Sealant Glazing."

F. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. EFCO Corporation.
2. Kawneer.
3. United States Aluminum.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance or Framing members are one-piece members that are internally slotted at regular intervals .

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type and as follows:

1. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.

   a. Color: Black.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by structural- and weatherseal-sealant and aluminum-framed system manufacturers for this use.

   a. Color: Matching structural sealant.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2. Door Design: As indicated.

   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

B. Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

1. Opening-Force Requirements:

   a. Egress Doors: Not more than 30 lbf (133 N) required to set door in motion and not more than 15 lbf (67 N) required to open door to minimum required width.
   b. Accessible Interior Doors: Not more than 5 lbf (22.2 N).

B. Scheduled Door Hardware: Provide door hardware according to the Door Hardware Schedule at the end of Part 3.

1. Named Manufacturer's Products: Product designation and hardware manufacturer are listed in the Door Hardware Schedule at the end of Part 3 to establish minimum requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware.
   a. Named products are basis-of-design products. Provide named hardware manufacturer's products or comparable products that are equivalent in function and quality and that are recommended and supplied by entrance system manufacturer.

2. References to BHMA Standards: Provide products complying with standards referenced in this Article and with requirements for description, quality, type, and function listed in the Door Hardware Schedule at the end of Part 3.

C. Pivot Hinges:

1. Standard: BHMA A156.4, Grade 1.
2. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

D. Ball-Bearing Butts:

1. Standard: BHMA A156.1, Grade 1, radius corner.
2. Provide nonremovable pins at hinges exposed to outside of door.
3. Provide nonferrous hinges where hinges are exposed to weather.
4. Quantities:

   a. For doors with heights up to 87 inches2210 mm, provide 3 hinges per leaf.
   b. For doors with heights of greater than 87 and up to 120 inches (2210 and up to 3048 mm), provide 4 hinges per leaf.

E. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles; fabricated to full height of door and frame.

F. Locking Devices, General: Do not require use of key, tool, or special knowledge for operation.

1. Opening-Force Requirements:

   a. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf (67 N) for not more than 3 seconds.
   b. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

H. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

1. Standard: BHMA A156.3, Grade 1.

I. Cylinders: BHMA A156.5, Grade 1.

1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

2. Doors Hardware: Cylinders for these doors need to be by BEST.

J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

K. Operating Trim: BHMA A156.6.

L. Removable Mullions:

1. Standard: BHMA A156.3.
2. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

M. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use, and adjustable to meet field conditions and requirements for opening force.

1. Standard: BHMA A156.4, Grade 1.

N. Concealed Overhead Holders: BHMA A156.8, Grade 1.

O. Surface-Mounted Holders: BHMA A156.16, Grade 1.

P. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

Q. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

R. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

S. Silencers: BHMA A156.16, Grade 1.

T. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).

1. Standard: BHMA A156.21.

U. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.7 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that 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 occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device (dutchman) to retain glazing in place while structural sealant cures.

E. Storefront Framing: Fabricate components for assembly using shear-block system or head-and-sill-receptor system with shear blocks at intermediate horizontal members.

F. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: Mill Aluminum

2.10 SOURCE QUALITY CONTROL

A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, sealant testing, and system fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.3 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.

3.4 DOOR HARDWARE SCHEDULE

A. See schedule located at the end of section 08711

END OF SECTION 08411

SECTION 08711 - DOOR HARDWARE (SCHEDULED BY NAMING PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

   a. Swinging doors.
   b. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
3. Division 8 Section "Access Doors" for access door hardware, except cylinders.
4. Division 8 Section "Aluminum Entrances and Storefronts" for entrance door hardware, except cylinders.
5. Division 13 Section "Intrusion Detection" for door switches as part of an intrusion detection system.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Cylinders for locks on aluminum and glass entrance doors.
2. Final replacement cores and keys to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. System schematic.

b. Point-to-point wiring diagram.
c. Riser diagram.
d. Elevation of each door.

2. Detail interface between electrified door hardware and fire alarm, access control, and security system.

C. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:

a. Hinges.
b. Pivots.
c. Locks and latches.
d. Bolts.
e. Exit devices.
f. Cylinders and keys.
g. Operating trim.
h. Closers.
i. Stops and holders.
j. Protective trim.
k. Door gasketing.
l. Thresholds.
m. Miscellaneous items.

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
5. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

I. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

J. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

a. Engineering Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, and FED-STD-795, "Uniform Federal Accessibility Standards," as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds.
c. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
d. Thresholds: Not more than 1/2 inch (13 mm) high.

3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, and security system.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

C. Warranty Period for Electromagnetic Locks: Five years from date of Substantial Completion.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

E. Warranty Period for Concealed Floor Closers: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

2.2 CYLINDERS AND KEYING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders: Same manufacturer as for locks and latches.

2. Key Control Systems:

a. Key Control Systems, Inc. (KCS).
b. Major Metalfab Co. (MM).
c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Sunroc Corporation (SUN).

C. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.
2. Key Control System: BHMA A156.5.

D. Cylinder Grade: BHMA Grade 1, unless Grade 2 is indicated.

E. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Five.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

F. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

G. Construction Keying: Comply with the following:
1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores, as directed by Owner.

H. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
2. Existing System: Master key or grand master key locks to Owner's existing system.
3. Keyed Alike: Key all cylinders to the same change key.

a. Cylinders shall be master keyed.

I. Keys: Provide nickel-silver keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra blank key for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.
d. Great-Grand Master Keys: Five.

J. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

1. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.

2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
3. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.
4. Capacity: Able to hold keys for 150 percent of the number of locks.
5. Cross-Index System: Set up by key control manufacturer, complying with the following:

    a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.
    b. Computer Software: Furnish cross-index software for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

2.3 STRIKES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Electric Strikes:

    a. Adams Rite Manufacturing Co. (ARM).
    b. Folger Adam Security Inc. (FAS).
    c. Hanchett Entry Systems, Inc. (HES).
    d. Locknetics Security Engineering; a Harrow Company (LSE).
    e. Precision Hardware, Inc. (PH).
    f. Rutherford Controls Inc.; Div. of Fritz Fuss (RC).
    g. Security Door Controls (SDC).
    h. Trine Products Company (TP).
    i. Von Duprin, Inc.; an Ingersoll-Rand Company (VD).

B. Standards: Comply with the following:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
4. Strikes for Auxiliary Deadlocks: BHMA A156.5.
5. Dustproof Strikes: BHMA A156.16.
6. Electric Strikes: BHMA A156.5.

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

D. Dustproof Strikes: BHMA Grade 1.

E. Electric Strikes: BHMA Grade 1, unless Grade 2 is indicated.

2.4 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Builders Hardware Mfg., Inc. (ABH).
2. Baldwin Hardware Corporation (BH).
3. Burns Manufacturing Incorporated (BM).
4. Door Controls International (DCI).
5. DORMA Door Controls Inc.; Member of The DORMA Group (DC).
6. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
7. Hager Companies (HAG).
8. Hanchett Entry Systems, Inc. (HES).
9. Hiawatha, Inc. (HIA).
10. Ives: H. B. Ives (IVS).
11. LCN Closers; an Ingersoll-Rand Company (LCN).
12. Norton Door Controls; Div. of Yale Security Inc. (NDC).
13. NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company (NTD).
14. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
15. Rixson-Firemark, Inc.; Div. of Yale Security Inc. (RIX).
16. Rockwood Manufacturing Company (RM).
17. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
18. Triangle Brass Manufacturing Company, Inc. (TBM).
19. Yale Security Inc.; Div. of Williams Holdings (YAL).

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Mechanical Door Holders: BHMA A156.16.
3. Electromagnetic Door Holders: BHMA A156.15.
4. Combination Overhead Holders and Stops: BHMA A156.8.
5. Door Silencers: BHMA A156.16.

C. Electromagnetic Door Holders for Labeled Fire Door Assemblies: Coordinate with fire detectors and interface with fire alarm system.

D. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide overhead holders.

E. Silencers for Wood Door Frames: BHMA Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame.

F. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.5 DOOR GASKETING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Door Gasketing:

a. Hager Companies (HAG).

b. National Guard Products, Inc. (NGP).
c. Pemko Manufacturing Co., Inc. (PEM).
d. Reese Enterprises, Inc. (RE).
e. Sealeze Corporation (SEL).
f. Ultra Industries; a Macklanburg-Duncan Company (ULT).
g. Zero International, Inc. (ZRO).

2. Door Bottoms:

a. Hager Companies (HAG).
b. National Guard Products, Inc. (NGP).
c. Pemko Manufacturing Co., Inc. (PEM).
d. Reese Enterprises, Inc. (RE).
e. Ultra Industries; a Macklanburg-Duncan Company (ULT).
f. Zero International, Inc. (ZRO).

C. Standard: Comply with BHMA A156.22.

D. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

E. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

F. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

G. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

H. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

I. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

J. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.6 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hager Companies (HAG).
2. National Guard Products, Inc. (NGP).
3. NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company (NTD).

4. Pemko Manufacturing Co., Inc. (PEM).
5. Reese Enterprises, Inc. (RE).
6. Rixson-Firemark, Inc.; Div. of Yale Security Inc. (RIX).
7. Ultra Industries; a Macklanburg-Duncan Company (ULT).
8. Zero International, Inc. (ZRO).

B. Standard: Comply with BHMA A156.21.

2.7 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.8 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
   1. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE

HARDWARE GROUP 1
DOOR: ENTRY DOOR E

1 SET	CYLINDERS (Exterior Set)	AS REQUIRED BY DOOR MANUFACTURER BALANCE OF HARDWARE BY OTHERS – Prep door for electric strike (HES1006 BLK Universal) Electric strike by Others. Also prep and provide a dead-bolt of a type that can be readily locked and unlocked without the use of a key from the inside and a key on the exterior. Also provide and install a sign on the interior side of the head frame that says "This door to remain unlocked when building is occupied. This sign will be in letters 1" high and on a contrasting background.

HARDWARE GROUP 2
DOOR: ENTRY DOOR E
(Interior Set) ALL HARDWARE BY DOOR MANUFACTURER

HARDWARE GROUP 3
DOORS: 102A, 109A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K7 AB 15 C	26D	BEST
1 EA	STOP	302	26D	QUALITY

HARDWARE GROUP 4
DOORS: 103A, 104A, 104B, 108A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K7 R 15 C	26D	BEST
1 EA	CLOSER	P4041 EDA		LCN
1 EA	SMOKE SEAL	PK55D		PEMKO
1 EA	KICKPLATE	10" X 2" LDW	32D	QUALITY
1 EA	STOP	307	26D	QUALITY

HARDWARE GROUP 5
DOORS: 110A, 111A, 112A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K7 D 15 C	26D	BEST
1 EA	CLOSER	P4041 EDA		LCN
1 EA	SMOKE SEAL	PK55D		PEMKO
1 EA	STOP	307	26D	QUALITY

HARDWARE GROUP 6
DOORS: 105A, 106A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K ON 15 C S3	26D	BEST
1 EA	CLOSER	P4041 EDA		LCN
1 EA	SMOKE SEAL	PK55D		PEMKO
1 EA	KICKPLATE	10" X 2" LDW	32D	QUALITY
1 EA	STOP	307	26D	QUALITY

HARDWARE GROUP 7
DOOR:, 101A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	EXIT	98L X IC CYL	26D	VON DUPRIN
1 EA	CLOSER	P4041 SPRING CUSH		LCN
1 EA	KICKPLATE	10” X 2” LDW	32D	QUALITY
1 EA	STOP	307	26D	QUALITY
1 EA	THRESHOLD	425		NG
1 EA	WEATHERSTRIP	PK55D		PEMKO
1 EA	DOOR BOTTOM	3452CNB		PEMKO

HARDWARE GROUP 8
DOORS: 107A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K OL 15 C S3	26D	BEST
1 EA	CLOSER	P4041 EDA		LCN
1 EA	SMOKE SEAL	PK55D		PEMKO
1 EA	KICKPLATE	10” X 2” LDW	32D	QUALITY
1 EA	STOP	307	26D	QUALIT

HARDWARE GROUP 9
DOOR: 001A

1.5 PAIR	BUTTS	BB 5000 4.5 X4.5	26D	BOMMER
1 EA	LOCKSET	93K7 D 15 C	26D	BEST
1 EA	CLOSER	P4041 SPRING CUSH		LCN
1 EA	KICKPLATE	10” X 2” LDW	32D	QUALITY
1 EA	THRESHOLD	425		NG
1 EA	WEATHERSTRIP	PK55D		PEMKO
1 EA	DOOR BOTTOM	3452CNB		PEMKO

END OF SECTION 08711

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes (but Is Not Necessarily Limited to):
1. Glass and glazing materials.
2. Mirrors.
3. Requirements for factory glazing of door and window units.

B. Related Sections:
1. Joint Sealants: Section 07920.
2. Steel Doors and Frames: Section 08110.
3. Wood Doors: Section 08210.
4. Metal-Clad Wood Windows: Section 08610.

1.2 REFERENCES

A. American National Standards Institute (ANSI): Z97.1, "Performance Specifications and methods of Test for Transparent Safety Glazing Material Used in Buildings."

B. American Society for Testing and Materials (ASTM):
1. C509: "Specification for Cellular Elastomeric Preformed Gasket and Sealing Material."
2. C1036: "Standard Specification for Flat Glass."
3. C1048: "Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass."
4. D2287: "Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds."
5. E773: "Test Method for Seal Durability of Sealed Insulating Glass Units."
6. E774: "Specification for Sealed Insulating Glass Units."

C. Consumer Products Safety Commission (CPSC): 16 CFR, Part 1201, "Safety Standard for Architectural Glazing Materials."

D. Flat Glass Marketing Association (FGMA):
1. Glazing Manual.
2. Sealant Manual.

E. International Conference of Building Officials (ICBO): Uniform Building Code.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
1. A watertight and airtight installation of each piece of exterior glass and sealed glass unit is required.
2. Each installation shall withstand local normal temperature changes, wind loading, and impact loading (for operating sash and doors) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, loss of hermetic seal, deterioration of glazing materials, and other defects in the work.
   a. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.

1.4 SUBMITTALS

A. Procedures: In accordance with Section 01300, "Submittal Procedures."

B. Product Data: Manufacturer's literature for all materials proposed for use substantiating that glass and glazing materials comply with specified requirements.

C. Verification Samples:
1. Glass: 12-inch-x-12-inch piece of each type proposed for use, except clear single-pane units.
2. Sealed Insulating Glass Unit: Samples shall be no less than 10 inches x 10 inches in size, constructed from same material and by method for units to be installed in Project.
3. Sealants and Gaskets:
   a. 12-inch-long section of each type of sealant and gasket, including molded corners, exposed to view.
   b. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.
4. Verification samples may be submitted as part of sample submittals required under other Sections.

D. Certificates:
1. Insulating Glass: Certification that units meet SIGMA Class CBA requirements.
2. Neoprene: From Manufacturer stating that neoprene materials conform to specified standards.
3. Sealants: The following statements for the installation:
   a. General: Signed by installer and Contractor stating that sealants installed comply with Specifications and that installation methods complied with manufacturer's written instructions for each condition of installation and use on this Project.
   b. Structural Sealant: The following from the manufacturer:
      1) Compatibility: Materials in contact with structural sealant are compatible therewith after 21 days' exposure to ultraviolet light (2,000-to-4,000-microwatt UV radiation).
      2) Stress: Joint dimension when subjected to 1.5 times specified wind load pressure and seismic drift, will not cause sealant stress to exceed 20 psi with a safety factor of as recommended in writing by the sealant manufacturer.

E. Test Reports: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with UBC Chapter 24, Section 2406.
2. Where safety glass is indicated or required, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category I or II materials as applicable.
3. Mirrors required to meet CPSC or ANSI safety glazing requirements shall be certified by the Safety Glazing Certification Council (SGCC).

B. Industry Standards:
1. Insulating glass shall be certified under a Sealed Insulating Glass Manufacturers' Association (SIGMA) approved certification program.
2. Comply with FGMA "Glazing Manual," except where more stringent requirements are indicated.

C. Minimum Wind Load for Exterior Glass and Glazing Assemblies: In accordance with UBC Chapter 16.

D. Sealant Compatibility and Adhesion Testing:
   1. Submit samples of all glass, gaskets, glazing accessories, and glass framing members proposed for use in contact with, or proximity of, glazing sealants, to sealant manufacturer for compatibility and adhesion testing in accordance with sealant manufacturer's standard testing methods and the following requirements:
      a. Durability Test: Bond-cohesion; after testing cut samples lengthwise and examining for bubbles.
      b. Adhesion in Peel: Each individual test; peel strength not less than 20 pounds per inch and no adhesion loss.
      c. Past Performance Tests: Not acceptable, except for uncoated-glass-to-uncoated-glass condition.
   2. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the work.
   3. Investigate materials failing compatibility or adhesion tests and obtain sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
   4. Submit certification of compatibility as specified in Article 1.4 above.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's label indicating type, quality, and thickness on each piece.

B. Protect glass and glazing materials during delivery, storage, and handling to comply with manufacturer's directions and as required to prevent face and edge damage to glass and damage to glass and glazing materials from effects of moisture, including condensation, and other causes.

C. Comply with the additional requirements specified in Section 01655, "Product Delivery, Storage, and Handling Requirements."

1.7 WARRANTY

A. Procedures: In accordance with Section 01786, "Product Warranties."

B. Submit written warranty for hermetically sealed insulating glass unit, agreeing to replace units which fail to maintain hermetic seal of air space, deteriorate, or otherwise fail to perform as required within warranty period as a result of failure of materials or workmanship.

C. By terms of warranty, also agree to remove or replace other work, as required, which has been connected to or superimposed on substrate material to be replaced.

D. The warranty period for hermetically sealed insulated glass units shall be 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.8 MANUFACTURERS

A. Acceptable Manufacturers and Fabricators: PPG Industries Inc., Pilkington LOF, or Viracon, unless otherwise noted.

2.9 GLASS MATERIALS

A. Annealed Float Glass: ASTM C1036, Type I, Class 1, Quality q3 or better.
   1. Thickness: Minimum thicknesses as recommended by manufacturer for size of light to be glazed

and design criteria.

B. Heat-Strengthened and Tempered Float Glass: ASTM C1036, Type I float glass as specified above and conforming to requirements of ASTM C1048 and as specified.
   1. Tempered glass shall meet ANSI Z97.1 test requirements.
   2. Glass shall be tempered using the roller hearth method.
   3. Heat-strengthened glass shall have surface compression levels between 3,500 psi and 7,000 psi.

C. Rolled Glass:
   1. Wire Glass: ASTM C1036, Type II, Class 1, Form 1, Quality q8, 6.0mm thick; Asahi, Pilkington-LOF, or accepted equal.
      a. Mesh Design: Baroque or Georgian (square).

D. Fire-Rated Glass: UL and WHI listed, 5/16 inch thick, visually clear ceramic, with polished surfaces; Premium "FireLite Plus" manufactured by Nippon Electric Glass Co. Ltd. and distributed by Technical Glass Products, Kirkland, WA, 1-800-426-0279.
   1. Rating: As scheduled on the Drawings.

E. Insulating Glass: Certified under SIGMA-approved program and meeting CBA Grade requirement when tested in accordance with ASTM E773 and ASTM E774.
   1. Units shall be fabricated from float glass as specified herein.
   2. Provide tempered glass for both lights of glass where indicated or required by code.
   3. Both interior and exterior light shall be clear.
   4. Glass thickness and size shall be determined by glass manufacturer and insulating glass fabricator based on design criteria.

F. Mirror Glass: ASTM C1036, Type I, Class 1, quality q2, 1/4 inch thick.
   1. Provide silver coating, copper-protective coating, and 1-mil-thick mirror backing paint.
   2. Comply with CS 27.
   3. Grind smooth all exposed edges.

2.10 GLAZING MATERIALS

A. Sealants for Glazing:
   1. Interior Locations:
      a. Typical: One-part, gun grade; Tremco "Mono," Pecora "60 Plus" or accepted equal.
   2. Exterior Locations: One-part, gun-grade silicone; GE "Silicone Construction Sealant Series SCS-1200," Dow-Corning "999 Building Sealant," or accepted equal.
      a. Color: As selected by Architect.

B. Joint Backer: Diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

C. Silicone Glazing Materials: Provide silicone setting blocks, jamb blocks, and sealant joint backer or spacers in lieu of neoprene if recommended by sealant manufacturer for compatibility with sealant.
   1. Corners, sizes, profiles, and color as specified for neoprene glazing materials.

D. Glazing Blocks and Spacers: Closed-cell neoprene complying with ASTM C509, in black color.

E. Glazing Tape: Butyl rubber type, black color; Pecora "Extru-Seal Tape G-66," Tremco "440 Tape," or accepted equal.

F. Mirror Adhesive: "Mirro-Mastic" by Palmer Products Corp. or accepted equal warranted for 5 years.

G. Accessory Materials: Miscellaneous clips, and fastenings as required and as standard with window or door manufacturer.

2.11 FABRICATION, GENERAL

A. Glazing channel dimensions shall provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Provide correct glass size for each opening, within tolerances and necessary dimensions established.

B. Factory-label each pane of glass. Do not remove labels until final acceptance is obtained.

C. Tempered glass shall be horizontally tempered with roller ripples in horizontal direction.
1. Where required, include an inconspicuous but visible permanent identifying label on each pane in accordance with ANSI Z97.1.
a. Fused to glass and located in a lower corner.
b. Include manufacturer's name or trademark, glass type, thickness, and designation of treatment.
c. Maximum warpage in accordance with Pilkington LOF or PPG standards.
2. Provide fireman's tempered-glass marker where required by local fire department.

D. Edge Treatment:
1. Edges at butt-joint glazing shall be flat ground with a 1/16-inch ground 45-degree seam and polished, unless otherwise indicated on the Drawings.
2. Edges for glass at architectural woodwork items shall be flat polished.

E. Dimensional Tolerances: Glass shall comply with referenced standards, except for the following:
1. Edge bow in open or closed joint butt-glazed situation shall not cause misalignment of adjacent panels in excess if 1/8 inch.
2. Width of joint dimension shall not vary within any butt joint by more than 1/16 inch.
3. Width of joint dimension shall not vary from nominal dimension by more than 1/16 inch.

F. Organic Coated Mirrors: Provide backing tape on back of mirrors which are less than 36 inches above finished floor to keep glass fragments together should mirrors be accidentally shattered; "CRL" shatterproof safety tape as manufactured by C.R. Laurence Co., 800-421-6411, or accepted equal.
1. Taped mirrors shall comply with 16 CFR 1201, ANSI Z97.1, and UBC Standard 24-1 for impact testing as a Category I or II as required by installation.

2.12 FABRICATION OF SEALED INSULATING GLASS UNITS

A. Insulating glass units shall be fabricated using dual-sealed system consisting of two lights of glass, primary seal of polyisobutylene specifically manufactured for primary insulating glass seals, and secondary seal of two-part silicone insulating glass sealant manufactured by G.E., Dow-Corning, or accepted equal.

B. Spacer frame shall be fabricated from aluminum filled with desiccant, and corners shall be ultrasonically soldered.
1. Color: As selected by Architect.

C. Primary sealant consisting of polyisobutylene shall be applied by continuous extrusion to spacer frame, making certain adequate quantity of sealant is applied to ensure a proper seal.

D. Secondary seal of IGS 3204 two-part silicone sealant, manufactured by G.E. or Dow-Corning, shall be applied in accordance with manufacturer's current instructions without void zones between primary and secondary seal.

E. Insulating glass units shall be manufactured by a licensee of IGCC or shall be certified by an approved independent testing laboratory as complying with specification ASTM E6 P3 using the P_1 or P_2 test method, Class A level or better.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Require installer to examine substrates for conditions relating to glass installation.

B. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.2 GLAZING

A. Comply with combined printed recommendations of glass manufacturers and manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. Tempered Glass:
1. Locations: Provide tempered glass where indicated and required in accordance with regulatory requirements specified in Article 1.5, "Quality Assurance," above.
2. Cutouts: Provide cutouts for fittings and hardware where indicated.

C. Protect glass from edge damage during handling and installation.
1. Use a rolling block in rotating glass units to prevent damage to glass corners.
2. Use suction cups to shift glass units within openings.
3. Do not raise or drift glass with a pry bar.
4. When glass has flares or bevels along one horizontal edge which would occur in vicinity of setting blocks, install with flares or bevels at top of opening.
5. Use glazing tape and shims to properly position glass.

D. Remove from Project, and dispose of glass units with edge damage or other imperfections of any kind that, when installed, weaken glass and impair performance and appearance.

E. Install setting blocks of proper size at sill, located one quarter of glass width from each corner, unless otherwise required. Set blocks in sealant acceptable for heel bead use.

F. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

G. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

H. Compression Gaskets: Provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
1. Miter-cut at corners, and install in manner recommended by gasket manufacturer to prevent pull-away at corners.
2. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.
3. Install gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets.

I. Mirror Adhesive: Apply in accordance with manufacturer's recommendations over primer/sealer on substrate.
1. Do not apply over water-resistant gypsum board that has not been primed.

2. Install to allow 1/8-inch space between back of mirror and surface of wall.
3. Use metal clips to support unframed mirrors at lower and top edge. Do not rest mirrors directly on counter top backsplashes or tile.

3.3 PROTECTION AND CLEANING

A. Do not apply markers to surfaces of glass.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

D. Remove nonpermanent labels, and wash glass on both faces not more than 10 days prior to date scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08800

SECTION 08814 - MIRRORED GLASS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Silvered mirrored glass.

B. Related Sections include the following:

1. Division 8 Section "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Division 10 Section "Toilet and Bath Accessories" for metal-framed mirrors.

1.3 DEFINITIONS

A. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.4 PERFORMANCE REQUIREMENTS

A. Provide mirrored glass that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.
2. Mirror mastic.
3. Mirror hardware.

B. Shop Drawings: Include elevations, sections, details, and attachments to other Work.

C. Samples for Verification: For the following products, in sizes indicated below:

1. Mirrored glass, 12 inches square, including edge treatment on 2 adjoining edges.
2. Mirror clips.

D. Product Certificates: Signed by manufacturers of mirrored glass [**and mirror mastic**] certifying that products furnished comply with requirements.

E. Mirror Mastic Glass Coating Compatibility Test Reports: From an organic protective coating manufacturer indicating that mirror mastic has been tested for compatibility and adhesion with organic protective coating applied to silvered mirrored glass. Include organic coating manufacturers' interpretation of test results relative to performance and recommendations for use of mastics with organic protective coating.

F. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed mirrored glass installations similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Mirrored Glass: Obtain mirrored glass from one source for each type of mirrored glass indicated.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each type of accessory indicated.

D. Glazing Publications: Comply with published recommendations in GANA's "Glazing Manual," unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

E. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

F. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For silvered mirrored glass, comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty for Silvered Mirrored Glass: Written warranty, made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Mirror Company, Inc.
2. Carolina Mirror Company.
3. Donisi Mirror Company.
4. Gardner Glass Products.
5. Gilded Mirrors, Inc.
6. Lenoir Mirror Company.
7. Stroupe Mirror Co., Inc.
8. Sunshine Mirror.
9. Virginia Mirror Co., Inc.
10. VVP America, Inc.; Binswanger Mirror Products.
11. Walker Glass Co., Ltd.

2.2 FLOAT GLASS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), class, quality, and other properties as indicated below:

1. Clear Annealed Float Glass: Class 1 (clear), Quality q2 (mirror).

a. Thickness: 5 mm.

2.3 MIRRORED GLASS

A. Silvered Mirrored Glass: Annealed, clear float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.

2.4 FABRICATION

A. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.

B. Cutouts: Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.

C. Mirrored Glass Edge Treatment: Treat edges as indicated below.
1. Rounded polished edge.
2. Seal edges of silvered mirrored glass after edge treatment to prevent chemical or atmospheric penetration of glass coating.
3. Require mirrored glass manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

2.5 MISCELLANEOUS MATERIALS

A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.

B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Gunther Mirror Mastics.
b. Palmer Products Corporation.

D. Mirror Bottom Clips: As indicated.

E. Mirror Top Clips: As indicated.

F. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.

1. Profile: As indicated.

G. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

H. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrored glass units are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

2. Proceed with mirrored glass installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 GLAZING

A. General: Install mirrored glass units to comply with written instructions of mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

B. Provide space for air circulation between back of mirrored glass units and face of mounting surface.

C. Mastic Spot Installation System: Install mirrored glass units with mastic as follows:

1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.
2. Apply mastic in spots to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrored glass units and face of mounting surface.
3. After mastic is applied, align mirrored glass units and press into place while maintaining a minimum air space of 1/8 inch between back of mirrored glass and mounting surface.

D. For wall-mounted mirrored glass units, install permanent means of support at bottom and top edges with bottom support designed to withstand mirrored glass weight and top support designed to prevent mirrored glass from coming away from wall along top edges.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrored glass units.
2. For metal or plastic clips, place a felt or plastic pad between mirrored glass and each clip to prevent spalling of mirrored glass edges.
3. Where indicated, install bottom and top trim. Fabricate trim in single lengths to fit and cover top and bottom edges of mirrored glass units.
4. Where indicated, install bottom trim and top clips. Fabricate bottom trim in single lengths to fit and cover bottom edge of mirrored glass units. Locate top clips so they are symmetrically placed and evenly spaced.
5. Where indicated, install bottom and top clips symmetrically placed and evenly spaced.

3.4 PROTECTION AND CLEANING

A. Protect mirrored glass from breakage and contaminating substances resulting from construction operations.

1. Do not permit edges of silvered mirrored glass to be exposed to standing water.
2. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.

B. Wash mirrored glass not more than four days before date scheduled for inspections intended to establish date for Substantial Completion. Wash mirrored glass by methods recommended in NAAMM

publication and in writing by mirrored glass manufacturer. Use water and glass cleaners free from substances capable of damaging mirrored glass edges or coatings.

END OF SECTION 08814

SECTION 09100 – FRP WALL PANEL

Part 1: General

1.01 Scope
FRP (Fiberglass Reinforced Plastic) wall panels for sanitary and/or decorative environments.

1.02 *Delivery and Storage of Materials*
Materials are to factory packaged on strong pallets. All materials are to be stored at or near room temperature in a dry place.

Part 2: Products

2.01 Manufacturer
Manufacturers include but not limited to the following:
1. Marlite
2. Kemlite

2.02 Materials

FRP wall panels shall be:

Color: White
Texture: Pebbled
Size: Minimize joints

Trim Molding as required.

Outside Corner Guards as required.

Base Molding as required.

C-551 Marlite FRP Adhesive or C-375 Marlite Construction Adhesive (or equal) as required.

MS-251 White Marlite Silicone Sealant (or equal) as required.

Part 3: Execution

3.01 Preparation
FRP Panels must be applied over a smooth, solid, flat, clean subwall such as drywall or plywood.

3.02 Conditioning
Panels should be opened and allowed to acclimate for 48 hours prior to installation.

3.03 Installation

Install all panels in strict accordance with the manufacturer's installation instructions. All Trim Molding must provide for a minimum 1/8" expansion space to insure proper installation.

3.04 Maintenance

Wipe down panels using a damp cloth and mild soap solution or cleaner. Refer to the manufacturer's specific cleaning recommendations. Do not use abrasive cleaners.

End of Section

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Exterior gypsum board panels for ceilings and soffits.
3. Exterior gypsum wallboard.
4. Tile backing panels.
5. Non-load-bearing steel framing.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing.
2. Division 6 Section "Rough Carpentry " for wood framing and furring, and gypsum sheathing applied over wood framing.
3. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.
5. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." GA-600, "Fire Resistance Design Manual."

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

C. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.

1. Install mockups for the following applications:

a. Surfaces with texture finishes.
b. Surfaces indicated to receive nontextured paint finishes.
c. Surfaces indicated to receive textured paint finishes.

2. Simulate finished lighting conditions for review of mockups.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Framing and Furring:

a. Clark Steel Framing Systems.
b. Consolidated Systems, Inc.
c. Dale Industries, Inc. - Dale/Incor.
d. Dietrich Industries, Inc.
e. MarinoWare; Division of Ware Ind.
f. National Gypsum Company.
g. Scafco Corporation.
h. Unimast, Inc.
i. Western Metal Lath & Steel Framing Systems.
j. Pre-Approved Equal

2. Gypsum Board and Related Products:

a. American Gypsum Co.
b. G-P Gypsum Corp.
c. National Gypsum Company.
d. United States Gypsum Co.
e. Pre-Approved Equal

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

C. Hanger Attachments to Concrete: As follows:

1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to [**10**] <**Insert number**> times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

D. Hangers: As follows:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
2. Rod Hangers: ASTM A 510, mild carbon steel.

a. Diameter: 7/32-inch.
b. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized.

3. Angle Hangers: ASTM A 653/A 653M, G60, hot-dip galvanized commercial-steel sheet.

a. Minimum Base Metal Thickness: 0.0179 inch.
b. Size: 1-5/8 by 1-5/8 inches.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with manufacturer's standard corrosion-resistant zinc coating.

1. Depth: 2-1/2 inches or as indicated.

F. Furring Channels (Furring Members): Commercial-steel sheet with manufacturer's standard corrosion-resistant zinc coating.

1. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange, 3/4 inch deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base Metal Thickness: 0.0179 inch.
b. Depth: As indicated.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base Metal Thickness: 0.0179 inch.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

   a. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.

G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
   b. USG Interiors, Inc.; Drywall Suspension System.
   c. Pre-Approved Equal.

2.3 STEEL PARTITION AND SOFFIT FRAMING

A. Components, General: As follows:

1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.
2. Depth: As indicated.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

D. Proprietary Deflection Track: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Delta Star, Inc., Superior Metal Trim; Superior Flex Track System (SFT).
   b. Metal-Lite, Inc.; Slotted Track.

E. Proprietary Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
   b. Metal-Lite, Inc.; The System.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base Metal Thickness: 0.0179 inch.

G. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: As indicated.
2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.
2. Depth: ¾ inch.

I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.

J. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:

a. Thickness: As indicated.
b. Long Edges: Tapered.
c. Location: As indicated.

2. Type X:

a. Thickness: As indicated.
b. Long Edges: Tapered.
c. Location: As indicated.

C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

3. Location: As indicated.

D. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.
3. Location: As indicated.

E. Proprietary, Special Fire-Resistive Type: ASTM C 36, having improved fire resistance over standard Type X.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.; FireBloc Type C.
b. G-P Gypsum Corp.; Firestop Type C.
c. National Gypsum Company; Gold Bond Fire-Shield G.
d. United States Gypsum Co.; SHEETROCK Brand Gypsum Panels, FIRECODE C Core ULTRACODE Core.

2. Thickness: As indicated.
3. Long Edges: Tapered.
4. Location: As indicated.

F. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.

2. Core: As indicated.
3. Long Edges: Tapered.
4. Location: As indicated.

2.5 EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Exterior Gypsum Soffit Board: ASTM C 931/C 931M, with manufacturer's standard edges.

1. Core: As indicated.

C. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Dens-Glass Gold" by G-P Gypsum Corp.
2. Core: As indicated.

2.6 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
2. Core: As indicated.

C. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. United States Gypsum Co.; DUROCK Cement Board.

2. Thickness: 1/2 inch.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
   a. Bullnose Bead: Use at outside corners.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
   c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
   d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges .
   e. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:

   a. Cornerbead: Use at outside corners.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fry Reglet Corp.
   b. Gordon, Inc.

c. MM Systems Corporation.
d. Pittcon Industries.
e. Pre-Approved Equal.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
b. Pecora Corp.; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.10 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

G. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

2.11 TEXTURE FINISHES

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Polystyrene Aggregate Ceiling Finish:

   a. G-P Gypsum Corp.; GyProc Ceiling Texture/Polystyrene.
   b. National Gypsum Company; Gold Bond Perfect Spray.
   c. United States Gypsum Co.; SHEETROCK Ceiling Spray Texture, QT Polystyrene.
   d. Insert manufacturer and product.

2. Aggregate Finish:

   a. G-P Gypsum Corp.; GyProc Vermiculite Ceiling Texture.
   b. United States Gypsum Co.; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

3. Acoustical Finish:

   a. International Cellulose Corp.; SonaSpray "fc."
   b. United States Gypsum Co.; USG Acoustical Plaster Finish.

B. Primer: As recommended by textured finish manufacturer.

C. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indices of not more than 25 when tested according to ASTM E 84.

   1. Texture: Medium.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

   1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

   a. Use deep-leg deflection track where indicated.
   b. Use proprietary deflection track where indicated.
   c. Use proprietary firestop track where indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. For exterior soffits, install cross bracing and framing to resist wind uplift.

E. Screw furring to wood framing.

F. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

a. Terminate partition framing at suspended ceilings where indicated.

D. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

E. Curved Partitions:

1. Cut top and bottom track (runners) through leg and web at 2-inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
2. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
3. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch- high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.
4. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

H. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced [**24 inches**] [**600 mm**] o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

I. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section "Building Insulation."

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Form control and expansion joints with space between edges of adjoining gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Floating Construction: Where feasible, and not required by fire ratings, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.

M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of board.
b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

G. Curved Partitions:

1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
4. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
5. Allow wetted gypsum panels to dry before applying joint treatment.

H. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

I. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
3. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

4. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
5. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
3. *Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.*

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions,

texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.11 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air-duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control-air tubing.
    f. Installation of ceiling support framing.

END OF SECTION 09260

SECTION 09512 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:

1. Concealed suspension systems.
2. Direct attachment of tiles to substrates with adhesive.
3. Direct attachment of tiles to substrates with staples.

B. Related Sections include the following:

1. Division 9 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
2. Division 9 Section "Acoustical Snap-in Metal Pan Ceilings."
3. Division 9 Section "Linear Metal Ceilings."
4. Division 9 Section "Suspended Decorative Grids."

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. LR: Light Reflectance coefficient.

C. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: [**1/4 inch = 1 foot (1:48)**] [**1/8 inch = 1 foot (1:96)**] [**1:50**] [**1:100**] <**Insert scale**>.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension System Members: 12-inch- (300-mm-) long Sample of each type.
3. Exposed Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type and color.

E. Qualification Data: For testing agency.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.

G. Research/Evaluation Reports: For acoustical tile ceiling and components[**and anchor type**].

H. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class [**A**] [**B**] [**C**] materials as determined by testing identical products per ASTM E 84:

    a. Smoke-Developed Index: 450 or less.

E. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
5. <**Insert requirement of authorities having jurisdiction.**>

F. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Coating-Based Antimicrobial Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273.

D. Tile-Based Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.3 M**ODULAR,** MINERAL-BASE ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING C-1

A. **Available** Products:

1. Armstrong or equal

B. Material:

1. Model: Cortega 769A.
2. Style: Fissyred, square lay-in.
3. Size: 2 ft. x 4 ft.

C. Material: For Alternate #2
1. Model: Cortega Tegular
2. Size: 24” x 24”
3. Edge: Beveled Tegular

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place anchors.
b. Type: Postinstalled expansion anchors.
c. Type: Postinstalled adhesive anchors.
d. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
e. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 alloy 304 or 316 for bolts; alloy 304 or 316 for anchors.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING C-1

A. Products:

1. Armstrong or equal.

B. Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytic zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.

1. Model: Prelude XL
2. Size: 15/16 inch.

C. Suspension System for Alternate #2:.

1. Model – Suprafine XL.
2. Size: 9/16 inch.

2.6. METAL EDGE MOLDINGS AND TRIM

A. [**Available**]Manufacturers:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. Fry Reglet Corporation.
4. Gordon, Inc.
5. MM Systems, Inc.
6. USG Interiors, Inc.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for alloy and temper 6063-T5.
2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
3. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
4. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; Organic coating as follows):

   a. Manufacturer's standard factory-applied prime-coat finish ready for field painting.

5. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
6. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

a. Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

2.7 MISCELLANEOUS MATERIALS

A. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with [**ASTM C 636**] [**UBC Standard 25-2**] and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.
2. Install tiles with pattern running in one direction parallel to long axis of space.
3. Install tiles with pattern running in one direction parallel to short axis of space.
4. Install tiles in a basket-weave pattern.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 INSTALLATION, DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

A. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:

1. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
2. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
3. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

B. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:

1. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
2. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
3. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

D. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.
2. Install tiles with pattern running in one direction parallel to long axis of space.
3. Install tiles with pattern running in one direction parallel to short axis of space.
4. Install tiles in a basket-weave pattern.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09512

SECTION 09651 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Resilient wall base and accessories under state contract, corrdinated with carpet section.

3. Vinyl composition tile (VCT).

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: Full-size units of each color and pattern of resilient floor tile required.

C. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives, including printed statement of VOC content.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than [**70 deg F (21 deg C)**] or more than [**95 deg F (35 deg C)**] in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than [**55 deg F (13 deg C)**] or more than [**95 deg F (35 deg C)**]

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.3 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide VCT by one of the following manufacturers:

a. AB ColorPlus, American Biltrite (Canada) Ltd.;
b. Armstrong World Industries, Inc.;
c. Azrock Commercial Flooring, DOMCO;
d. Congoleum Corporation;
e. Mannington Mills, Inc.;
f. Tarkett Inc.;

B. Color and Pattern: **As selected from manufacturer's full range**.

C. Class: **2 (through-pattern tile)**

D. Wearing Surface: **Embossed**.

E. Thickness: [**0.125 inch (3.2 mm)**]

F. Size: 12 by 12 inches (305 by 305 mm).

G. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

1.1 TOP SET RUBBER BASE (per state contract)

A. Wall Base: ASTM F 1861. as selected by architect from manufactures full range of standard products and colors.

1. AFCO-USA, American Floor Products Company, Inc.;
2. Armstrong World Industries, Inc.;
3. Azrock Commercial Flooring, DOMCO;

4. Burke Mercer Flooring Products;
5. Endura;
6. Estrie, American Biltrite (Canada) Ltd.;
7. Johnsonite;
8. Marley Flexco (USA), Inc.;
9. Mondo Rubber International, Inc.;
10. Musson, R. C. Rubber Co.;
11. Nora Rubber Flooring, Freudenberg Building Systems, Inc.;
12. Pirelli Rubber Flooring;
13. Roppe Corporation;
14. Stoler Industries;
15. VPI, LLC, Floor Products Division;
16. or equal

B. Type (Material Requirement): **TV (vinyl)** to match stair tread and riser tile.

C. Group (Manufacturing Method): **solid, homogeneous**

D. Style: **Cove with top-set toe**

E. Minimum Thickness: **0.125 inch**

F. Height: **4 inches (102 mm)**

G. Lengths: **Coils in manufacturer's standard length**

H. Outside Corners: **Job formed or premolded**.

I. Inside Corners: **formed or premolded**.

J. Surface: Smooth

1.2 RESILIENT MOLDING per state contract

A. Description: **Joiner for tile and carpet, and other transition strips as selected from manufacturers full range of standard products and colors.**

1. Burke Mercer Flooring Products;
2. Johnsonite;
3. Marley Flexco (USA), Inc.;
4. Roppe Corporation
5. Stoler Industries;
6. or equal

B. Material: **Vinyl**
Profile and Dimensions: **As selected by Architect.**

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT and Asphalt Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.
c. Rubber Floor Adhesives: 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [**3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)**] in 24 hours.
b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. 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 that equal less than one-half tile at perimeter.

1. Lay tiles **in pattern indicated**

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles **in pattern of colors and sizes indicated**.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

a. Do not wash surfaces until after time period recommended by manufacturer.

I. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09651

SECTION 09680 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes floor carpet and accessories as per the state of Utah's contract with Midwest Office Supply and as listed herein. General contractor is to coordinate installation with the same. Pre-determined prices for carpet including installation are available.

B. Architect will coordinate with the state carpet contractor to develop layouts and location of carpet patterns and colors. The information will be submitted to the DFCM project manager for final approval before ordering.

C. Related Sections include the following:

1. Division 9 Section **"Resilient Wall Base and Accessories"**, **"Resilient Tile Flooring"** for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet type, color, and dye lot.
5. Locations where dye lot changes occur.
6. Seam locations, types, and methods.
7. Type of subfloor.
8. Type of installation.
9. Pattern type, repeat size, location, direction, and starting point.
10. Pile direction.
11. Type, color, and location of insets and borders.
12. Type, color, and location of edge, transition, and other accessory strips.
13. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- (300-mm-) square Sample.
2. Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.
3. Carpet Cushion: not used.
4. Carpet Seam: 6-inch (150-mm) Sample.
5. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

D. Mockups: Before installing carpet, install mockups for each type of carpet installation required to demonstrate aesthetic effects and qualities of materials and execution. Install mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Install mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be installed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Remove mockups when directed.

7. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY (by state carpet contract)

PART 2 - PRODUCTS

2.1 CARPET (by state carpet contract)

A. Available Product[**s**]: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Product[**s**]: Subject to compliance with requirements, provide the following:

1. Carpet per State of Utah contract #PD-392 Arches – Z6317

a. Colors: **As selected by Architect from manufacturer's full range**.

b. Sources:

1) Wall 2 Wall Floor Coverings: (p) 288-2794
2) Henrickson/Butler: (p) 363-5881
3) Resource Utah: (p) 355-9300

2. Manufacturer: Shaw industries, Designweave per Berkshire Hathaway Company.

C. Fiber Content: Premise SD Solution Dyed Nylon

D. Face Construction: **loop pile** graphic

E. Gauge: 1/10 inch

F. Stitches: 9.0

G. Pile Height: .187.

H. Total Weight: 28 **oz.**.

I. Primary Backing: Polypropylene

J. Secondary Backing: Action bac

K. Width: 12 **feet**

2.2 INSTALLATION ACCESSORIES (by state carpet contract)

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:

1. Carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:

1. Carpet manufacturer.
2. Carpet cushion manufacturer.

C. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

E. Rubber Accessory moldings

PART 3 - EXECUTION

3.1 EXAMINATION (by state carpet contract)

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet

performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:

   a. Carpet manufacturer.
   b. Carpet cushion manufacturer.

2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:

1. Carpet manufacture

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."

B. Do not bridge building expansion joints with carpet.

C. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09680

SECTION 09911 - PAINTING (CONSUMER LINE PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Metal toilet enclosures.
c. Metal lockers.
d. Unit kitchens.
e. Elevator entrance doors and frames.
f. Elevator equipment.
g. Finished mechanical and electrical equipment.
h. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
2. Division 2 Section "Cement Concrete Pavement" for traffic-marking paint.
3. Division 5 Section "Structural Steel" for shop priming structural steel.
4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
5. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
6. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
7. Division 8 Section "Custom Steel Doors and Frames" for factory priming steel doors and frames.
8. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
9. Division 9 Section "Exterior Wood Stain."

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For 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 required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit samples on the following substrates for Architect's review of color and texture only:

a. Concrete: 4-inch- square Samples for each color and finish.
b. Concrete Unit Masonry: 4-by-8-inch Samples of masonry, with mortar joint in the center, for each finish and color.
c. Painted Wood: 8-inch- square Samples for each color and material on hardboard.
d. Stained or Natural Wood: 4-by-8-inch Samples of natural- or stained-wood finish on representative surfaces.
e. Ferrous Metal: 3-inch- square Samples of flat metal and 6-inch- long Samples of solid metal for each color and finish.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall Surfaces: Provide samples on at least 100 sq. ft.
b. Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:

a. Exterior, Flat Acrylic Paint: 1 gal. of each color applied.
b. Exterior, Low-Luster Acrylic Finish: 1 gal. of each color applied.
c. Exterior, Semigloss Acrylic Enamel: 1 gal. of each color applied.
d. Exterior, Full-Gloss Alkyd Enamel: 1 gal. of each color applied.
e. Interior, Flat Acrylic Paint: 1 gal. of each color applied.
f. Interior, Low-Luster Acrylic Finish: 1 gal. of each color applied.
g. Interior, Semigloss Acrylic Enamel: 1 gal. of each color applied.
h. Interior, Full-Gloss Alkyd Enamel: 1 gal. of each color required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. Coronado Paint Company (Coronado).
3. ICI Dulux Paint Centers (ICI Dulux Paints).
4. PPG Industries, Inc. (Pittsburgh Paints).
5. Sherwin-Williams Co. (Sherwin-Williams).
6. Kwal-Howels (Kwal-Howells).
7. Pre-Approved Equal

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match Architect's samples.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.

1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
2. Coronado; 946-11 Super Kote 5000 Commercial Latex Block Filler: Applied at a dry film thickness of not less than 8.4 mils.
3. ICI Dulux Paints; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils.
4. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
5. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moore's Latex Exterior Primer No. 102: Applied at a dry film thickness of not less than 1.4 mils.
2. Coronado; 48-11 Elast-O-Meric Acrylic Masonry Sealer: Applied at a dry film thickness of not less than 1.2 mils.
3. ICI Dulux Paints; 2001-1200 Dulux Exterior Latex Primer: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; Loxon Exterior Masonry Acrylic Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils.

B. Exterior Gypsum Soffit Board Primer: Factory-formulated alkyd- or alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moorwhite Primer No. 100: Applied at a dry film thickness of not less than 2.1 mils.
2. Coronado; 410-11 Crylicote Gold Exterior Acrylic House Paint Primer: Applied at a dry film thickness of not less than 1.3 mils.
3. ICI Dulux Paints; 2001-1200 Dulux Exterior Latex Primer: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W41: Applied at a dry film thickness of not less than 3.0 mils.

C. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; IronClad Alkyd Low Lustre Metal & Wood Enamel No. 163: Applied at a dry film thickness of not less than 1.3 mils.
2. Coronado; 35-147 Rust Scat Alkyd Metal Primer: Applied at a dry film thickness of not less than 1.8 mils.
3. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 7-858 Pittsburgh Paints Industrial Rust Inhibitive Steel Primer: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils.

D. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.

1. Benjamin Moore; IronClad Latex Low-Lustre Metal & Wood Enamel No. 363: Applied at a dry film thickness of not less than 1.6 mils.
2. Coronado; 36-11 Rust Scat Latex Metal Primer: Applied at a dry film thickness of not less than 1.3 mils.
3. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
5. Sherwin-Williams; Galvite HS Paint B50WZ3: Applied at a dry film thickness of not less than 2.0 mils.

E. Exterior Aluminum Primer under Acrylic Finishes: Factory-formulated acrylic-based metal primer for exterior application.

1. Benjamin Moore; IronClad Latex Low-Lustre Metal & Wood Enamel No. 363: Applied at a dry film thickness of not less than 1.6 mils.
2. Coronado; 180-11 High Performance Acrylic Metal Primer: Applied at a dry film thickness of not less than 1.6 mils.
3. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils.
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
5. Sherwin-Williams; DTM Acrylic Primer/Finish B66W1: Applied at a dry film thickness of not less than 2.5 mils.

2.5 INTERIOR PRIMERS

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Benjamin Moore; Regal FirstCoat Interior Latex Primer & Underbody No. 216: Applied at a dry film thickness of not less than 1.0 mil.
2. Coronado; 78-11 Super Kote 5000 Acrylic Enamel Undercoat: Applied at a dry film thickness of not less than 1.6 mils.
3. ICI Dulux Paints; 1000-1200 Dulux Ultra Basecoat Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils.
4. Sherwin-Williams; PrepRite Masonry Primer B28W300: Applied at a dry film thickness of not less than 3.0 mils.

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Regal FirstCoat Interior Latex Primer & Underbody No. 216: Applied at a dry film thickness of not less than 1.0 mil.
2. Coronado; 40-11 Super Kote 5000 Latex Primer-Sealer: Applied at a dry film thickness of not less than 1.1 mils.
3. ICI Dulux Paints; 1000-1200 Dulux Ultra Basecoat Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils.
4. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
5. Sherwin-Williams; PrepRite Masonry Primer B28W300 Series: Applied at a dry film thickness of not less than 3.0 mils.

C. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.

1. Benjamin Moore; Moore's Alkyd Enamel Underbody No. 217: Applied at a dry film thickness of not less than 1.4 mils.
2. Coronado; 78-11 Super Kote 5000 Acrylic Enamel Undercoat: Applied at a dry film thickness of not less than 1.6 mils.
3. ICI Dulux Paints; 1000-1200 Dulux Ultra Basecoat Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils.
4. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater: Applied at a dry film thickness of not less than 1.0 mil.
5. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils.

D. Interior Wood Primer for Full-Gloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.

1. Benjamin Moore; Moore's Alkyd Enamel Underbody No. 217: Applied at a dry film thickness of not less than 1.4 mils.
2. Coronado; 75-11 Super Kote 5000 Acrylic Enamel Undercoater: Applied at a dry film thickness of not less than 2.0 mils.
3. ICI Dulux Paints; 1120-1200 Ultra-Hide Oil/Alkyd Interior Wood Undercoat: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 6-6 SpeedHide Interior Quick-Drying Enamel Undercoater: Applied at a dry film thickness of not less than 1.4 mils.
5. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils.

E. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.

1. Benjamin Moore; IronClad Alkyd Low Lustre Medal and Wood Enamel No. 163: Applied at a dry film thickness of not less than 1.3 mils.
2. Coronado; 35-147 Rust Scat Alkyd Metal Primer: Applied at a dry film thickness of not less than 1.8 mils.
3. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 7-858 Pittsburgh Paints Industrial Rust Inhibitive Steel Primer: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils.
6. <**Insert manufacturer's interior primer.**>

F. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

1. Benjamin Moore; IronClad Latex Low Lustre Metal and Wood Enamel No. 363: Applied at a dry film thickness of not less than 1.6 mils.
2. Coronado; 36-11 Rust Scat Latex Metal Primer: Applied at a dry film thickness of not less than 1.3 mils.
3. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
5. Sherwin-Williams; primer not required over this substrate.
6. <**Insert manufacturer's interior primer.**>

2.6 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.

1. Benjamin Moore; MoorLife Latex House Paint No. 105: Applied at a dry film thickness of not less than 1.5 mils.
2. Coronado; 10-Line Premium Gold Collection Acrylic One Coat Flat House Paint: Applied at a dry film thickness of not less than 1.4 mils.
3. ICI Dulux Paints; 2201-XXXX Dulux Ultra Latex Flat Finish: Applied at a dry film thickness of not less than 1.4 mils.
4. Pittsburgh Paints; 10 Line Pitt-Cryl Exterior Water Base Paint: Applied at a dry film thickness of not less than 1.5 mils.
5. Pittsburgh Paints; 72 Line Sun-Proof Exterior Flat Latex House Paint: Applied at a dry film thickness of not less than 1.5 mils.
6. Sherwin-Williams; SuperPaint Exterior Latex Flat House and Trim Paint, A80 Series: Applied at a dry film thickness of not less than 1.4 mils.

B. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.

1. Benjamin Moore; MoorGard Latex House Paint No. 103: Applied at a dry film thickness of not less than 1.1 mils.
2. Coronado; 410 Line Crylicote Gold Collection Satin Acrylic House & Trim: Applied at a dry film thickness of not less than 1.2 mils.
3. ICI Dulux Paints; 2403-XXXX Dulux Exterior Latex Satin Finish: Applied at a dry film thickness of not less than 1.4 mils.
4. Pittsburgh Paints; 76 Line Sun-Proof Exterior House & Trim Acrylic Satin Latex: Applied at a dry film thickness of not less than 1.0 mil.
5. Sherwin-Williams; SuperPaint Exterior Latex Satin Wall Paint A89 Series: Applied at a dry film thickness of not less than 1.4 mils.

C. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; MoorGlo Latex House & Trim Paint No. 096: Applied at a dry film thickness of not less than 1.2 mils.
2. Coronado; 2 Line Crylicote Gold Collection Gloss Acrylic House & Trim Enamel: Applied at a dry film thickness of not less than 1.2 mils.
3. ICI Dulux Paints; 2407-XXXX Dulux Exterior Latex Semi-Gloss Finish: Applied at a dry film thickness of not less than 1.3 mils.
4. Pittsburgh Paints; 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint: Applied at a dry film thickness of not less than 1.2 mils.
5. Sherwin-Williams; SuperPaint Exterior Gloss Latex A-84 Series: Applied at a dry film thickness of not less than 1.4 mils.

D. Exterior Full-Gloss Acrylic Enamel for Concrete, Masonry, and Wood: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Impervex Latex High Gloss Metal & Wood Enamel No. 309: Applied at a dry film thickness of not less than 1.2 mils.
2. Coronado; 80 Line Rust Scat Acrylic Latex High Gloss Enamel: Applied at a dry film thickness of not less than 1.1 mils.
3. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 3.0 mils.
4. Pittsburgh Paints; 90 Line Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils.
5. Sherwin-Williams; SuperPaint Exterior High Gloss Latex Enamel A85 Series: Applied at a dry film thickness of not less than 1.3 mils.

E. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Impervex Enamel High Gloss Metal & Wood Enamel No. 309: Applied at a dry film thickness of not less than 1.2 mils.
2. Coronado; 80 Line Rust Scat Acrylic Latex High Gloss Enamel: Applied at a dry film thickness of not less than 1.1 mils.
3. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 51-Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel: Applied at a dry film thickness of not less than 1.3 mils.
5. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series: Applied at a dry film thickness of not less than 2.4 mils.

F. Exterior Full-Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.

1. Benjamin Moore; Moore's House Paint No. 110: Applied at a dry film thickness of not less than 2.0 mils.
2. Coronado; 9 Line Gold Collection Gloss Oil House & Trim Enamel: Applied at a dry film thickness of not less than 2.0 mils.
3. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 7-814 Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; Industrial Enamel B54 Series: Applied at a dry film thickness of not less than 2.0 mils.

2.7 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.

1. Benjamin Moore; Regal Wall Satin No. 215 Premium Interior Finishes Flat Finish: Applied at a dry film thickness of not less than 1.3 mils.
2. Coronado; 26 Line Gold Acrylic Latex Flat Wall Paint: Applied at a dry film thickness of not less than 1.1 mils.
3. ICI Dulux Paints; 1201-XXXX Dulux Ultra Velvet Sheen Interior Flat Latex Wall & Trim Finish: Applied at a dry film thickness of not less than 1.7 mils.
4. Pittsburgh Paints; 80-Line Wallhide Interior Wall Flat Latex Paint: Applied at a dry film thickness of not less than 1.2 mils.
5. Sherwin-Williams; SuperPaint Interior Latex Flat Wall Paint, A86 Series: Applied at a dry film thickness of not less than 1.5 mils.

B. Interior Flat Latex-Emulsion Size: Factory-formulated flat latex-based interior paint.

1. Benjamin Moore; Colorscapes Interior Latex Flat No. 515: Applied at a dry film thickness of not less than 1.4 mils.
2. Coronado; 28 Line Super Kote 5000 Vinyl Latex Flat Wall: Applied at a dry film thickness of not less than 1.0 mil.
3. ICI Dulux Paints; 1201-XXXX Dulux Ultra Velvet Sheen Interior Flat Latex Wall & Trim Finish: Applied at a dry film thickness of not less than 1.7 mils.
4. Pittsburgh Paints; 6-700 Series SpeedHide Ultra Interior Wall Flat Latex 100 Percent Acrylic: Applied at a dry film thickness of not less than 1.0 mil.
5. Sherwin-Williams; SuperPaint Flat Wall Paint A86 Series: Applied at a dry film thickness of not less than 1.5 mils.

C. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Moore's Regal AquaVelvet No. 319: Applied at a dry film thickness of not less than 1.4 mils.
2. Coronado; 34 Line Tough Walls Acrylic Eggshell Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.2 mils.
3. ICI Dulux Paints; 1403-XXXX Dulux Ultra Eggshell Interior Latex Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 89-Line Manor Hall Interior Eggshell Wall and Trim: Applied at a dry film thickness of not less than 1.4 mils.
5. Sherwin-Williams; SuperPaint Interior Latex Satin Wall Paint A87 Series: Applied at a dry film thickness of not less than 1.6 mils.

D. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Benjamin Moore; Regal AquaGlo No. 333 Premium Interior Finishes Latex Semi-Gloss: Applied at a dry film thickness of not less than 1.3 mils.
2. Coronado; 22 Line Tough Walls Acrylic Semi-Gloss Enamel: Applied at a dry film thickness of not less than 1.1 mils.
3. ICI Dulux Paints; 1407-XXXX Dulux Ultra Semi-Gloss Interior Acrylic Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.1 mils.
5. Sherwin-Williams; SuperPaint Interior Latex Semi-Gloss Enamel A88 Series: Applied at a dry film thickness of not less than 1.6 mils.

E. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

1. Benjamin Moore; Impervex Enamel No. 309: Applied at a dry film thickness of not less than 1.2 mils.
2. Coronado; 414 Line Super Kote 5000 Acrylic High Gloss Enamel: Applied at a dry film thickness of not less than 1.2 mils.
3. ICI Dulux Paints; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils.
4. Pittsburgh Paints; 51 Line Brilliant Reflections Interior/Exterior Latex Gloss Enamel: Applied at a dry film thickness of not less than 1.3 mils.
5. Sherwin-Williams; ProMar 200 Interior Latex Gloss Enamel B21W201: Applied at a dry film thickness of not less than 1.5 mils.

F. Interior Semigloss Alkyd Enamel: Factory-formulated semigloss alkyd enamel for interior application.

1. Benjamin Moore; Satin Impervo Alkyd Low Lustre Enamel No. 235: Applied at a dry film thickness of not less than 1.3 mils.
2. Coronado; 23 Line Premium Gold Collection Alkyd Semi-Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils.
3. ICI Dulux Paints; 1516-XXXX Ultra-Hide Alkyd Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.7 mils.
4. Pittsburgh Paints; 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series: Applied at a dry film thickness of not less than 1.7 mils.

G. Interior Full-Gloss Alkyd Enamel for Gypsum Board and Plaster: Factory-formulated full-gloss alkyd interior enamel.

1. Benjamin Moore; Impervo Enamel No. 133: Applied at a dry film thickness of not less than 1.7 mils.
2. Coronado; 1223 Line Super Kote 5000 High Gloss Alkyd Enamel: Applied at a dry film thickness of not less than 1.5 mils.
3. ICI Dulux Paints; 4308-XXXX Devguard Alkyd Industrial Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils.
4. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

H. Interior Full-Gloss Alkyd Enamel for Wood and Metal Surfaces: Factory-formulated full-gloss alkyd interior enamel.

1. Benjamin Moore; Impervo Enamel No. 133: Applied at a dry film thickness of not less than 1.7 mils.
2. Coronado; 1223 Line Super Kote 5000 High Gloss Alkyd Enamel: Applied at a dry film thickness of not less than 1.5 mils.
3. ICI Dulux Paints; 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel: Applied at a dry film thickness of not less than 1.5 mils.
4. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils.
5. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

I. Interior Epoxy paint for walls.

1. 97-130 Aquapon Series

2.8 INTERIOR WOOD STAINS AND VARNISHES

A. Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Penetrating Stain No. 234.
2. Coronado; 69-27 Oil Penetrating Wood Stain.
3. ICI Dulux Paints; 1700-XXX WoodPride Interior Solventborne Wood Finishing Stain.
4. Pittsburgh Paints; 77-560 Rez Interior Semi-Transparent Oil Stain.
5. Sherwin-Williams; Wood Classics Interior Oil Stain A-48 Series.

B. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Moore's Interior Wood Finishes Quick-Dry Sanding Sealer No. 413.
2. Coronado; 81-10 Dual Seal.
3. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
4. Pittsburgh Paints; 6-10 SpeedHide Quick-Drying Interior Sanding Wood Sealer and Finish.
5. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43.

C. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish: Factory-formulated alkyd- or polyurethane-based clear varnish.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.
2. Coronado; 151-100 Alkyd Clear Satin Varnish.
3. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
4. Pittsburgh Paints; 77-7 Rez Varnish, Interior Satin Oil Clear.
5. Sherwin-Williams; Wood Classics Fast Dry Oil Varnish, Satin A66-300 Series.

D. Interior Waterborne Clear Satin Varnish: Factory-formulated clear satin acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
2. Coronado; 70-100 Aqua-Plastic Urethane Clear Satin.
3. ICI Dulux Paints; 1802-0000 WoodPride Interior Waterborne Aquacrylic Satin Varnish.
4. Pittsburgh Paints; 77-49 Rez Satin Acrylic Clear Polyurethane.
5. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.

E. Interior Waterborne Clear Gloss Varnish: Factory-formulated clear gloss acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes High Gloss No. 428.
2. Coronado; 70-10 Aqua-Plastic Urethane Clear Gloss.
3. ICI Dulux Paints; 1808-0000 WoodPride Interior Waterborne Aquacrylic Gloss Varnish.
4. Pittsburgh Paints; 77-45 Rez Full-Gloss Acrylic Clear Polyurethane.
5. Sherwin-Williams; Wood Classics Waterborne Polyurethane Gloss, A68 Series.

F. Paste Wax: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt,

grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. 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.

a. 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 dried.
b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
c. If transparent finish is required, backprime with spar varnish.
d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: 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 SSPC's recommendations.
a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of 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.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Pipe hangers and supports.
3. Tanks that do not have factory-applied final finishes.
4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
5. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
6. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

B. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

C. Mineral-Fiber-Reinforced Cement Panels: Provide the following finish systems over exterior, mineral-fiber-reinforced cement panels:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

D. Exterior Gypsum Soffit Board: Provide the following finish systems over exterior gypsum soffit board:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

E. Smooth Wood: Provide the following finish systems over smooth wood siding, wood trim, and other smooth exterior wood surfaces:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

F. Wood Trim: Provide the following finish systems over exterior wood trim:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

G. Plywood: Provide the following finish systems over exterior plywood:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

H. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

I. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

J. Aluminum: Provide the following finish systems over exterior aluminum surfaces:
1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

3.8 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

C. Mineral-Fiber-Reinforced Cement Panels: Provide the following finish systems over interior mineral-fiber-reinforced cement panels:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

D. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

E. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

F. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

G. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

3.9 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

B. Natural-Finish Woodwork: Provide the following natural finishes over new interior woodwork:
   1. As indicated on Paint Schedule on Drawings or the end of Section 09911.

END OF SECTION 09911

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes **metal** units as follows:

1. Toilet Enclosures: **Overhead braced** and **Floor anchored**
2. Urinal Screens: **Wall-mounted**

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed finish.

PART 2 - PRODUCTS

2.1 METAL UNITS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Hadrian Inc.
10. Knickerbocker Partitions Corp.
11. Lambaton Universal.
12. Metpar Corp.
13. Sanymetal; a Crane Plumbing Company.
14. Weis-Robart Partitions, Inc.

Baked-Enamel Units: Facing sheets and closures fabricated from ASTM A 591/A 591M, 80Z (24G) (electrolytically zinc-coated) or ASTM A 653/A 653M (hot-dip galvanized or galvannealed), commercial steel sheet for exposed applications, that is mill phosphatized, and selected for smoothness.

Finish: Manufacturer's standard pigmented, organic coating.

Color: [**One color**] in each room as selected by Architect from manufacturer's full range of colors.

D. Pilaster [**Shoes**] [**and**] [**Sleeves (Caps)**]: Stainless steel, ASTM A 666, Type 302 or 304.

E. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; **stainless steel**

2.5 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: As selected by architect from manufacturers standard range, or the following; **Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear anodized aluminum**] [**Stainless steel**] [**Chrome-plated brass**].

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Wall Supports for Urinal Screens: Manufacturer's standard stainless steel angles for wall supported construction.

D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.6 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be accessible to people with disabilities.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard **recessed** latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

   a. Pilasters and Panels: 1/2 inch (13 mm).
   b. Panels and Walls: 1 inch (25 mm).

2. Full Length Brackets: Secure panels to walls and to pilasters with not less than **as recommended by manufacturer** near top and bottom of panel.

   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10155

SECTION 10200 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed, extruded-aluminum louvers.
2. Fixed, formed-metal louvers.
3. Adjustable louvers.
4. Insulated adjustable louvers.
5. Acoustical louvers.
6. Wall vents (brick vents).

B. Related Sections include the following:

1. Division 3 Section “Cast in Place Concrete” for louvers in concrete floors and walls.

2. Division 4 Section “Unit Masonry Assemblies” for louvers in masonry walls.

3. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
4. Division 8 Section "Steel Doors and Frames" for louvers in hollow-metal doors and frames.
5. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
6. Division 9 Section " Painting (Professional Line Products) " for field painting louvers.
7. Division 14 Section "Hydraulic Elevators" for venting of elevator shafts.
8. Division 15 Sections for louvers that are a part of mechanical equipment.
9. Division 16 Sections for electrical power connections for motor-operated adjustable metal louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent

damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.

1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to 2000 IBC.

1. Seismic Design Criteria: As indicated by 2000 IBC for site location.

C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

A. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

1. For installed louvers and vents indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Wiring Diagrams: Power, signal, and control wiring for motorized adjustable louvers.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Company (The).
c. American Warming and Ventilating, Inc.
d. Arrow United Industries.
e. Carnes Company, Inc.
f. Cesco Products.
g. Construction Specialties, Inc.
h. Dowco Products Group; Safe-Air of Illinois, Inc.
i. Greenheck.
j. Industrial Louvers, Inc.
k. Louvers & Dampers, Inc.
l. Metal Form Manufacturing Company, Inc.
m. NCA Manufacturing, Inc.
n. Nystrom Building Products.
o. Reliable Products; Hart & Cooley, Inc.
p. Ruskin Company; Tomkins PLC.
q. Vent Products Company, Inc.
r.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. [**4**] [**6**] finish.

F. Fasteners: Of 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 Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

G. Postinstalled 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 E 488, conducted by a qualified independent testing agency.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Maintain equal louver blade spacing to produce uniform appearance.

E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel, unless otherwise indicated.

F. Include supports, anchorages, and accessories required for complete assembly.

G. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

H. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.

I. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.6 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

B. Powder-Coated Finish: Prepare, treat, and coat galvanized metal louvers to comply with resin manufacturer's written instructions and as follows:

1. Prepare louvers by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared louvers with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
4. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. 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.

F. Protect galvanized and nonferrous-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.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

SECTION 10431 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Panel signs.
2. Dimensional characters (letters and numbers) [**and logos**] [**for exterior use**].
3. Illuminated characters (letters and numbers).
4. Cast-metal plaques.
5. Signage accessories.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary project identification signs.
2. Division 10 Section "Directories and Bulletin Boards" for building directories.
3. Division 10 Section "Post and Panel Signs" for freestanding exterior [**aluminum**] [**fiberglass**] panel signs[**, including accessible parking signs**].
4. Division 10 Section "Pylon Signs" for freestanding exterior signs.
5. Division 14 Section "[**Electric Traction Elevators**] [**Hydraulic Elevators**]" for code-required elevator signage.
6. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
7. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
8. Division 16 Section "Interior Lighting" for illuminated exit signs.
9. See Division 16 Sections for electrical service and connections for illuminated characters and for access to remote transformers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, [**artwork,**]and braille layout.
2. Wiring Diagrams: For signs with illuminated characters.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Casting: Show representative texture, character style, spacing, finish, and method of attachment.
4. Approved samples will[**not**] be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: [**An employer of workers trained and approved by signage manufacturer**] [**An authorized representative of signage manufacturer for installation and maintenance of units required for this Project**].

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Illuminated Exit Signs: Refer to Division 16. <**Insert requirements.**>
b. Fire Doors: <**Insert requirements.**>
c. Room Capacity: <**Insert requirements.**>
d. Elevator Signs: <**Insert requirements.**>
e. Stairway Identification: <**Insert requirements.**>
f. Live Load Capacity: <**Insert requirements.**>
g. Signs for Accessible Spaces: <**Insert requirements.**>

D. 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.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

B. Coordinate location of remote transformers with building construction. Ensure that transformers are accessible after completion of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
3. Basis-of-Design Product: The design for each sign is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Basis-of-Design Product: <**Insert manufacturer's name; product name or designation**> or a comparable product of one of the following:

1. <**Insert, in separate subparagraphs, manufacturer's name.**>

C. [**Available**]Manufacturers:

1. Allenite Signs; Allen Marking Products, Inc.
2. American Graphics Inc.
3. Andco Industries Corp.
4. APCO Graphics, Inc.
5. ASI Sign Systems, Inc.
6. Best Manufacturing Co.
7. Grimco, Inc.
8. Innerface Sign Systems, Inc.
9. Kaltech Industries Group, Inc.
10. Mills Manufacturing, Inc.
11. Mohawk Sign Systems.
12. Seton Identification Products.
13. Signature Signs, Inc.
14. Supersine Company (The).
15. <**Insert manufacturer's name.**>

D. Cast-Acrylic Sheet: Manufacturer's standard and as follows:

1. Color: [**As indicated by manufacturer's designations**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

E. Plastic Laminate: Provide high-pressure laminate engraving stock with face and core plies [**in contrasting colors**] [**in finishes and color combinations indicated**] [**as selected by Architect from manufacturer's full range**].

F. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.

G. Phenolic-Backed Photopolymer Sheet: Provide light-sensitive, water-wash photopolymer face layer bonded to a phenolic base layer to produce a composite sheet with overall, face-layer, and base-layer thicknesses, respectively, of [**0.120 inch, 0.040 inch, and 0.080 inch**] [**0.160 inch, 0.040 inch, and 0.120 inch**]; and a Type D Shore durometer hardness of 80.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into Work includes, but is not limited to, "[**Jet-288**] [**Jet-388**] Phenolic Interior Signage" by JetUSA.

H. PVC: Extruded, high-impact PVC plastic [**in color indicated**] [**in color as selected by Architect**] [**in color to match face color**] [**with painted finish**].

I. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition: [**Square cut**] [**Beveled**] [**Bull nose**].
2. Corner Condition: [**Square**] [**Rounded to radius indicated**].

J. Frames: Fabricate frames to profile indicated; comply with the following requirements for materials and corner conditions:

1. Material: [**Aluminum, extruded or cast**] [**Acrylic plastic**] [**PVC**].
2. Corner Condition: [**Square**] [**Rounded to radius indicated**].

K. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.

L. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint brackets in color [**matching background color of panel sign**] [**matching Architect's sample**] <**Insert color**>.

M. Graphic Content and Style: Provide sign copy that complies with requirements indicated [**in the Sign Schedule**] [**on Drawings**] [**on artwork supplied on electronic media by Architect**] for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

N. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of [**slide-in inserts**] [**transparent covers with paper inserts printed by Owner**] [**changeable panel inserts for use in fixed frames**] <**Insert item**>.

1. Furnish paper and software for creating text and symbols for [**IBM compatible**] [**Macintosh**] computers for Owner production of paper inserts.
2. Furnish paper cut-to-size for changeable message insert.

O. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: [**Opaque acrylic sheet**] [**Photopolymer**] [**Clear acrylic sheet with opaque color coating, subsurface applied**].
2. Raised-Copy Thickness: Not less than 1/32 inch.

P. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
2. Engraved Metal: Fill engraved copy with enamel.
3. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.
4. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with enamel. Apply opaque background color coating to back face of acrylic sheet.

Q. Subsurface Copy: Apply minimum 4-mil- thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free from rough edges.

R. Subsurface Engraved Acrylic Sheet: Reverse-engrave back face of clear acrylic sheet. Fill resulting copy with enamel. Apply opaque background color coating over enamel-filled copy.

S. Applied Copy: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply copy to [**exposed face of panel sign**] [**glass**] [**doors**] [**wall surfaces**] <**Insert substrate**>.

1. Panel Material: [**Opaque acrylic sheet**] [**Clear acrylic sheet with opaque color coating, subsurface applied**].

T. Colored Coatings for Acrylic Sheet: For copy [**and**] [**background**] [**and frame**] colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.3 DIMENSIONAL CHARACTERS

A. [**Available**]Manufacturers:

1. American Graphics Inc.
2. A.R.K. Ramos.
3. ASI Sign Systems, Inc.
4. Charleston Industries, Inc.
5. Gemini Incorporated.
6. Grimco, Inc.
7. Innerface Sign Systems, Inc.
8. Kaltech Industries Group, Inc.
9. Metal Arts; Div. of L&H Mfg.
10. Mills Manufacturing, Inc.
11. Mohawk Sign Systems.
12. Signature Sign Signs, Inc.
13. Southwell Co. (The).
14. <**Insert manufacturer's name.**>

B. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 6063-T5.

D. Copper Alloys, Bronze Plate:

1. Plate: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
2. Sand Castings: ASTM B 584, alloy UNS No. C83600 (No. 1 manganese bronze).

E. Copper Alloys, Brass:

1. Plate: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
2. Sand Castings: ASTM B 584, alloy UNS No. C85200 (high-copper yellow brass).

F. Stainless-Steel Plate, Sheet, and Strip: Provide stainless-steel plate, sheet, and strip, Type 302 or Type 304, complying with ASTM A 666.

G. Cast-Acrylic Sheet: Manufacturer's standard and as follows:

1. Color: [**As indicated by manufacturer's designations**] [**As selected by Architect from manufacturer's full range**] <**Insert color**>.

H. Cast Characters: Form individual letters and numbers by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Material: [**Aluminum**] [**Bronze**] [**Cast- or formed-acrylic sheet**].

I. Cutout Characters: Cut characters from solid plate of thickness and metal indicated. Produce precisely cut characters with square cut, smooth[**, eased**] edges. Comply with requirements indicated for finish, style, and size.

1. Metal: [**Aluminum**] [**Bronze**] [**Brass**] [**Stainless steel**] <**Insert material**>.

J. Fabricated Characters: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.

1. Aluminum Sheet: Not less than 0.090 inch thick.
2. Bronze Plate: Not less than 0.032 inch thick.
3. Brass Plate: Not less than 0.032 inch thick.
4. Stainless-Steel Sheet: Not less than 0.050 inch thick for face and 0.031 inch thick for returns.
5. <**Insert material and thickness.**>
6. Character Height: [**2 inches**] [**As indicated**] <**Insert size**>.
7. Character Style: [**Helvetica**] [**Gothic**] [**Times Roman**] [**Futura**] <**Insert style**>.

K. Illuminated Characters: Illuminate characters in manner indicated using manufacturer's standard lighting components including [**fluorescent tubes**] [**neon tubes**] [**fiber optics**], transformers, insulators, and other components. Make provisions for servicing and concealing connections to building electrical system. Coordinate electrical characteristics with those of power supply provided.

1. Backlighted Characters: Provide concealed [**neon tubes**] [**fiber optics**] of number indicated or required by size of characters. Include manufacturer's hardware for projection mounting of characters at distance from wall surface indicated.
2. Facelighted Characters: Fabricate character faces from translucent acrylic sheet of thickness indicated. Attach characters to sheet metal back channels. Provide lighting tubes of number and spacing required to illuminate sign faces evenly.

2.4 CAST-METAL PLAQUES

A. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy.

B. [**Available**]Manufacturers:

1. A.R.K. Ramos.
2. American Graphics Inc.
3. Gemini Incorporated.
4. Matthews International Corporation; Bronze Division.
5. Metal Arts; Div. of L&H Mfg.
6. Mills Manufacturing, Inc.
7. Southwell Co. (The).
8. York Bronze/Bryan.
9. <**Insert manufacturer's name.**>

C. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

D. Bronze Castings: ASTM B 584, alloy UNS No. C83600 (No. 1 manganese bronze).

E. Border Style: [**None (straight), polished edge**] [**Plain bevel**] [**Projected bevel**] [**Raised flat band**] [**Double-raised line border**] <**Insert border style**>.

F. Background Texture: Manufacturer's standard [**pebble texture**] [**leatherette finish**] [**matte finish**] [**stipple finish**].

G. Mounting: [**Rosettes and fasteners matching plaque finish**] [**Concealed studs**] for substrates encountered.

2.5 PANEL SIGN TYPES

A. Room Signs:

1. Material: [**Cast-acrylic sheet**] [**Plastic laminate**] <**Insert material**>.
2. Perimeter: [**Unframed**] [**Framed**].
3. Copy: [**Tactile and braille**] [**Subsurface**] [**Surface**].
4. Character Style: [**Helvetica**] <**Insert style**>.
5. Text: [**As indicated in the Sign Schedule**] <**Insert text**>.
6. Message: [**Changeable**] [**Fixed**].
7. Sizes:

   a. Sign: <**Insert size.**>
   b. Character: Minimum [**1-inch-**] <**Insert height**> high characters.

8. Colors:

   a. Frame: <**Insert color.**>
   b. Character: <**Insert color.**>
   c. Background: <**Insert color.**>

9. Schedule: Refer to <**Insert schedule location**>.

B. Occupancy Signs:

1. Material: [**Cast-acrylic sheet**] [**Plastic laminate**] <**Insert material**>.
2. Perimeter: [**Unframed**] [**Framed**].
3. Copy: [**Raised**] [**Subsurface**] [**Surface**].
4. Character Style: [**Helvetica**] <**Insert style**>.
5. Text: [**Maximum occupancy load:** <**Insert load**>] [**As indicated in the Sign Schedule**].
6. Message: Fixed.
7. Sizes:

   a. Sign: <**Insert size.**>
   b. Character: Minimum [**1-inch-**] <**Insert height**> high characters.

8. Colors:

   a. Frame: <**Insert color.**>
   b. Character: <**Insert color.**>
   c. Background: <**Insert color.**>

9. Schedule: Refer to <**Insert schedule location**>.

C. Toilet Room Signs:

1. Material: [**Cast-acrylic sheet**] [**Plastic laminate**] <**Insert material**>.
2. Perimeter: [**Unframed**] [**Framed**].
3. Copy: Raised.
4. Character Style: [**Helvetica**] <**Insert style**>.
5. Text: [**According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.**] <**Insert text.**>
6. Message: Fixed.
7. Sizes:

   a. Sign: <**Insert size.**>
   b. Character: Minimum [**1-inch-**] <**Insert height**> high characters.

8. Colors:

   a. Frame: <**Insert color.**>
   b. Character: <**Insert color.**>
   c. Background: <**Insert color.**>

9. Schedule: Refer to <**Insert schedule location**>.

D. Wayfinding Signs:

1. Material: [**Cast-acrylic sheet**] [**Plastic laminate**] <**Insert material**>.
2. Perimeter: [**Unframed**] [**Framed**].

3. Copy: [**Subsurface**] [**Raised**] [**Surface**].
4. Character Style: [**Helvetica**] <**Insert style**>.
5. Graphics/Text: <**Insert graphics/text.**>
6. Message: [**Changeable**] [**Fixed**].
7. Sizes:

   a. Sign: <**Insert size.**>
   b. Character: Minimum [**1-inch-**] <**Insert height**> high characters.

8. Colors:

   a. Frame: <**Insert color.**>
   b. Character: <**Insert color.**>
   c. Background: <**Insert color.**>

9. Schedule: Refer to <**Insert schedule location**>.

E. Accessible Parking Signs:

1. Material: 0.080-inch [**stainless steel**] [**aluminum**] or other noncorrosive material.
2. Background Color: Blue.
3. Copy Material: [**White silk-screen**] [**Reflective vinyl**].
4. Mounting: Flush mounted to building with fasteners to suit building substrate.
5. <**Insert requirement of authorities having jurisdiction.**>

F. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.6 ACCESSORIES

A. Vinyl Film: Provide opaque [**nonreflective**] [**reflective**] vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

B. Mounting Methods: Use [**concealed fasteners**] [**hook-and-loop tape**] [**double-sided vinyl tape**] [**magnetic tape**] [**silicone adhesive**] fabricated from materials that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Note Holders: Manufacturer's standard aluminum paper sheet holders.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: Manufacturer's standard clear anodic coating, 0.018 mm or thicker, over a [**satin (directionally textured)**] [**polished (buffed)**] mechanical finish.

B. Color Anodic Finish: Manufacturer's standard integrally colored or electrolytically deposited color coating, 0.018 mm or thicker, in [**light bronze**] [**medium bronze**] [**dark bronze**] [**gold**] [**black**] with a [**satin (directionally textured)**] [**polished (buffed)**] mechanical finish.

C. Clear Finish: [**Natural satin**] [**Polished**] finish with clear polyurethane protective coat.

D. Baked-Enamel Finish: Manufacturer's standard baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

E. Cast-Metal Plaque Finishes:

1. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin finish.
2. Background Finish: [**Painted**] <**Insert finish**>.

2.9 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish.

C. Bright, Directional Polish: No. 4 finish.

D. Satin, Directional Polish: No. 6 finish.

E. Satin, Reflective, Directional Polish: No. 7 finish.

F. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.

G. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.10 COPPER-ALLOY FINISHES

A. [**Bronze**] [**Brass**] Plate: [**Medium satin (directionally textured)**] [**Smooth specular (mirrorlike), buffed**] finish.

B. Cast-[**Bronze**] [**Brass**] Character Finishes: Manufacturer's [**standard satin finish**] <**Insert finish**> with exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

C. Cast-Bronze Plaque Finishes: Exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

1. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin finish.
2. Background Finish: [**Painted**] [**Dark oxidized**] [**Green patina**] <**Insert finish**>.

D. Cast-Brass Plaque Finishes: Exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

1. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin finish.
2. Background Finish: [**Painted**] <**Insert finish**>.

E. Clear Protective Coating: Coat exposed surfaces of copper alloys with manufacturer's standard clear organic coating specially designed for coating copper-alloy products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items[**, including anchor inserts,**] [**and electrical power**] provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Hook-and-Loop Tapes: Use hook-and-loop tapes to mount signs to smooth, nonporous surfaces.

3. Magnetic Tape: Use magnetic tape to mount signs to smooth, nonporous surfaces.
4. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
5. Shim Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
6. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
7. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

C. Bracket-Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

D. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Flush Mounting: Mount characters with backs in contact with wall surface.
2. Projected Mounting: Mount characters at projection distance from wall surface indicated.

E. Cast-Metal Plaques: Mount plaques using standard fastening methods recommended in writing by manufacturer for type of wall surface indicated.

1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
2. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.

F. Illuminated Characters:

1. Run wires into wall construction through conduit.[**Use insulators as necessary for neon lighting wiring.**]
2. Exposed-to-view wiring or conduit on wall face is not permitted.
3. Engage a licensed electrician to connect wiring to power source.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 SIGN SCHEDULE

A. Sign Type <**Insert designation**>: <**Insert type**>.

1. Sign Size: <**Insert size.**>
2. Material: <**Insert material.**>

3. Background Finish/Color: <**Insert finish/color.**>
4. Character Finish/Color: <**Insert finish/color.**>
5. Character Size: <**Insert size.**>
6. Text/Message: <**Insert text/message.**>
7. Room: <**Insert designation.**>
8. Quantity: <**Insert quantity.**>

END OF SECTION 10431

SECTION 10436 - POST AND PANEL SIGNSF

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Nonilluminated, single-sheet-type post and panel signs.
2. Nonilluminated, hollow-box-type post and panel signs.
3. Internally illuminated post and panel signs.
4. Nonilluminated, multiple-message-bar-type post and panel signs.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary Project identification and temporary informational and directional signs.
2. Division 3 Section "Cast-in-Place Concrete" for concrete fill in postholes.
3. Division 10 Section "Signs" for wall-mounted signs.
4. Division 10 Section "Pylon Signs" for pylon-type signs.
5. Division 16 Sections for electrical service and connections for illuminated post and panel signs.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide post and panel signs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, determined according to <**Insert applicable code requirement**> [**ASCE 7, "Minimum Design Loads for Buildings and Other Structures"**]:

1. Wind Loads: Determine loads based on a uniform pressure of <**Insert design wind pressure**>, acting in any direction.

B. Thermal Movements: Provide post and panel signs that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include manufacturer's written instructions for maintaining and cleaning sign surfaces.

B. Shop Drawings: Show fabrication and installation details for post and panels signs.

1. Include plans, elevations, and at least 3/4-inch scale sections of typical members and other components. Show anchors, reinforcement, accessories, layout, and installation details.

a. Show locations of electrical service connections.

2. Include message list, with details of wording and lettering layout, at least half size. Include full-size details of graphics.

a. Include full-size templates for cutout characters and graphic symbols.

3. Wiring Diagrams: For internally illuminated signs.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Aluminum.
2. Acrylic sheet.
3. Polycarbonate sheet.
4. Fiber-reinforced polyester (fiberglass) sheet.
5. Die-cut vinyl characters and graphic symbols.[**Include representative samples of available type styles and graphic symbols.**]

D. Samples for Verification: For each type of product indicated, of size below:

1. Aluminum: For each form, finish, and color, on 6-inch- long sections of extrusions and squares of sheet at least 4 by 4 inches.
2. Acrylic Sheet: 8 by 10 inches for each color required.
3. Polycarbonate Sheet: 8 by 10 inches for each color required.
4. Fiber-Reinforced Polyester (Fiberglass) Sheet: 8 by 10 inches for each color required.[**Include embedded copy.**]

a. Include a sample of graphic-image process. Show graphic style and colors and finishes of letters, numbers, and other graphic devices.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of sign manufacturer for installation[**and maintenance**] of units required for this Project.

1. Installer shall be capable of providing replacement message bars within 10 working days of receipt of order.

B. Source Limitations: Obtain [**post and panel signs**] [**each type of post and panel sign**] through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of post and panel signs and are based on the specific type and model indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. 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.

1.6 DELIVERY AND HANDLING

A. Deliver post and panel signs in protective covering and crating to protect sign components and surfaces against damage.

1.7 COORDINATION

A. Coordinate installation of anchorages for post and panel signs. Furnish setting drawings, templates, and directions for installing anchorages and other items that are to be embedded in concrete. Deliver such items to Project site in time for installation.

B. Coordinate delivery time so signs can be installed within 24 hours of receipt at Project site.

1.8 WARRANTY

A. Fiberglass Panel Sign Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fiberglass panels that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Coating degradation.
2. Chalking.
3. Fading.
4. Fiberglass delamination or cracking.

B. Warranty Period: <**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for post and panel signs is based on <**Insert manufacturer's name and product**>. Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufacturers:

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Andco Industries Corporation.
2. APCO Graphics
3. ASI Sign System, Inc.

4. Best Manufacturing Co.
5. Charleston Industries, Inc.
6. Innerface Sign Systems, Inc.
7. Kaltech Industries Group, Inc.
8. Nelson-Harkins Industries; ABC Bulletin and Directory Division.
9. Signature Signs, Inc.
10. Supersine Company (The).
11. Vomar Products, Inc.
12. <**Insert manufacturer's name.**>

2.2 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.

D. Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels in sizes and thicknesses indicated, with a minimum tensile strength of 15,000 psi when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi when tested according to ASTM D 790.

E. Transparent, Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing), of thickness indicated, with Finish [**1 (smooth or polished finish)**] [**3 (abrasion-resistant coating)**]. Provide [**colorless sheet with visible light transmittance of 92 percent measured per ASTM D 1003**] [**colors selected by Architect from manufacturer's full range**].

F. Translucent, Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing), of thickness indicated, with Finish [**1 (smooth or polished finish)**] [**2 (patterned, matte finish)**] [**3 (abrasion-resistant coating)**]. Provide white colored sheet of density required to produce uniform brightness and minimum halation effects.

G. Opaque, Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing), of thickness indicated, and in colors and finishes indicated or, if not indicated, as selected by Architect from manufacturer's full range.

H. Abrasion-Resistant, Monolithic Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:

1. Physical Properties: Minimum values, unless otherwise indicated.

a. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
b. Tensile Strength: 9000 lb/sq. in. per ASTM D 638.
c. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
d. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
e. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.

2. Transparent Sheet: Colorless, with a minimum luminous transmittance of 84 percent for 0.236-inch thickness per ASTM D 1003.
3. Translucent Sheet: White polycarbonate sheet of density required to produce uniform brightness and minimum halation effects.
4. Opaque Sheet: Polycarbonate sheet in colors and finishes selected from manufacturer's full range.

I. Vinyl Film: Opaque, nonreflective vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior applications.

J. Colored Coatings for Plastic Sheet: Nonfading coatings, including inks and paints for copy and background colors. Use coatings that are recommended by manufacturers for optimum adherence to type of plastic used.

2.3 ACCESSORIES

A. Fasteners: Use concealed fasteners fabricated from metals that are noncorrosive to sign material and mounting surface.

B. Anchors and Inserts: Use stainless-steel or hot-dip galvanized anchors and inserts. Use torque-controlled expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete.

C. Concrete for Postholes: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 2500 psi, unless otherwise indicated.

2.4 FABRICATION, GENERAL

A. General: Provide manufacturer's standard post and panel signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 POSTS

A. General: Fabricate posts to lengths required for mounting method indicated.

1. Direct-Burial Method: Provide posts 36 inches longer than height of sign to permit direct embedment in concrete foundations.
2. Baseplate Method: Provide posts with baseplates, flanges, or other fittings, welded to bottom of posts. Drill holes in baseplate for anchor-bolt connection.

   a. Provide anchor bolts of size required for connecting posts to concrete foundations.

3. Reverse Sleeve Method: Provide inserts recommended by manufacturer, sized for close fit inside posts. Size inserts for direct embedment in concrete foundations and to attach sign posts securely and prevent sign from overturning when subjected to normal loading conditions prevailing at

Project site, but not less than 1/3 of post height plus 36 inches for embedment. Drill posts and inserts for through bolts for fastening them together.

a. Provide bolts for fastening posts to inserts.

B. Aluminum Posts: Manufacturer's standard 0.125-inch- thick, extruded-aluminum tubing, with vertical slots to engage sign panels. Provide stop blocks in slots to hold panels in position. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for complete installation.

1. Square Posts: [**2 inches**] [**3 inches**] [**3-1/4 inches**] [**4 inches**] <**Insert dimension**> square.
2. Rectangular Posts: [**1-3/4 by 3 inches**] [**2 by 3-1/4 inches**] [**2 by 6 inches**] [**2 by 8 inches**] [**2-1/2 by 3-1/4**] [**2-1/2 by 7-1/2 inches**] [**3 by 7 inches**] [**3 by 8 inches**] <**Insert dimensions**>.
3. Semicircular Posts: [**1 by 2 inches**] [**1-5/8 by 3-1/4 inches**] [**3-1/4 by 7-1/2 inches**] [**3-5/8 by 7-1/4 inches**] <**Insert dimensions**>.
4. Rounded-End Posts: [**2 by 2 inches**] [**4 by 4 inches**] <**Insert dimensions**>.
5. Beveled-Corner Posts: [**2 by 2 inches**] [**4 by 4 inches**] <**Insert dimensions**>.
6. Post Finish: [**Baked enamel**] [**Class I, color anodic coating**] [**High-performance organic coating**] [**Match sign panel face**].

C. Steel Posts: Fabricate from 0.120-inch- thick, square steel tubing. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for complete installation. Hot-dip galvanize post assemblies after fabrication to comply with ASTM A 123/A 123M.

1. Post Size: [**2 inches**] [**3 inches**] [**4 inches**] <**Insert dimension**> square.
2. Post Finish: [**Baked enamel matching sign panel face**] <**Insert requirements**>.

2.6 SIGN PANELS

A. General: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
2. Increase metal thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
3. Continuously weld joints and seams, unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

B. Unframed Single-Sheet Panels: Provide unframed single-sheet sign panels with edges mechanically and smoothly finished.

1. Panel Material: [**0.125-inch- thick aluminum sheet**] [**0.125-inch- thick fiberglass sheet**] [**0.125-inch- thick, opaque acrylic sheet**] [**0.125-inch- thick, opaque polycarbonate sheet**] [**0.250-inch- thick, opaque acrylic sheet**] [**0.250-inch- thick, opaque polycarbonate sheet**].

   a. Panel Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**].
   b. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.

2. Edge Condition: [**Square cut**] [**Beveled**] [**Rounded**].
3. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

C. Framed Single-Sheet Panels:

1. Panel Material: [**0.125-inch- thick aluminum sheet**] [**0.125-inch- thick fiberglass sheet**] [**0.125-inch- thick, opaque acrylic sheet**] [**0.125-inch- thick, opaque polycarbonate sheet**] [**0.250-inch- thick, opaque acrylic sheet**] [**0.250-inch- thick, opaque polycarbonate sheet**].

   a. Panel Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**].
   b. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.

2. Frame Material: Extruded aluminum, with integral slots to receive sign message panel.

   a. Frame Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**] [**Match finish of panel**].
   b. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

D. Hollow-Box-Type Panels: Provide hollow-box-type sign message panels formed from 0.090-inch- thick aluminum sheet with ends flanged to engage slots in posts or attached to posts with extruded-aluminum fittings. Close top and bottom edges of panels with welded seams or extrusions, as standard with manufacturer.

1. Panel Depth: [**2 inches**] [**3-1/4 inches**] <**Insert depth**> [**Provide panel same depth as posts**].
2. Panel Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**].

E. Hollow-Box-Type Panels: Provide hollow-box-type sign message panels formed from 0.090-inch- thick aluminum sheet that enclose supporting posts. Provide manufacturer's standard method of closure for sides, top, and bottom edges.

1. Panel Depth: [**2 inches**] [**Provide panel same depth as posts**].
2. Panel Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**].
3. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

F. Framed Hollow-Box-Type Panels:

1. Panel Material: [**0.090-inch- thick aluminum sheet**] [**0.125-inch- thick aluminum sheet**] [**0.125-inch- thick fiberglass sheet**] [**0.125-inch- thick, opaque acrylic sheet**] [**0.125-inch- thick, opaque polycarbonate sheet**] [**0.250-inch- thick, opaque acrylic sheet**] [**0.250-inch- thick, opaque polycarbonate sheet**].
   a. Panel Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**].

   b. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.
   c. Provide clips welded to back of panels for installation without visible fasteners.

2. Frame Material: [**Extruded aluminum**] <**Insert other material**>, fabricated to profile indicated; comply with the following:

   a. Frame Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**] [**Match finish of panel**].
   b. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

3. Illuminated-Sign Units: Provide internal illumination using concealed, internally wired, fluorescent-strip fixture system to illuminate message panels uniformly with minimum halation and without light leaks. Make provisions for servicing and for concealed connection to electric service. Coordinate electrical characteristics with those of power supply provided.

a. Fluorescent Tubes: Provide number of tubes indicated or required by sign-panel size.
b. Ballasts: Energy-saving, high power factor, Class P, electromagnetic type, designed for use with high-output lamps, and with automatic reset thermal protection. Ballasts comply with ANSI C82.1, bear Certified Ballast Manufacturer Certification labels, and are rated for [**0 deg F**] [**minus 20 deg F**] starting temperature.

G. Nonilluminated, Composite Box-Type Fiberglass Panels: Molded-fiberglass outer shell bonded to internal reinforcement.

1. Panel Face: Seamless, 0.125-inch- thick, molded fiberglass.
2. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.
3. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

H. Illuminated, Composite Box-Type Fiberglass Panels: Molded-fiberglass outer shells retained in extruded-aluminum frames.

1. Panel Face: Seamless, 0.125-inch- thick, molded fiberglass.
2. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.
3. Panel Frame Material: Extruded aluminum designed to provide electrical raceways and to retain removable molded-fiberglass panels.

a. Frame Finish: [**Baked enamel**] [**Class I, color anodic finish**] [**High-performance organic coating**] [**Match finish of panel**].
b. Corner Condition: [**Square corners**] [**Corners rounded to radius indicated**].

4. Panel Illumination: Provide internal panel illumination using concealed, internally wired, fluorescent-strip fixture system to illuminate message panels uniformly with minimum halation and without light leaks. Make provisions for servicing and for concealed connection to electric service. Coordinate electrical characteristics with those of power supply provided.

a. Fluorescent Tubes: Provide number of tubes indicated or required by sign-panel size.
b. Ballasts: Energy-saving, high power factor, Class P, electromagnetic type, designed for use with high-output lamps, and with automatic reset thermal protection. Ballasts comply with ANSI C82.1, bear Certified Ballast Manufacturer Certification labels, and are rated for [**0 deg F**] [**minus 20 deg F**] starting temperature.

I. Multiple-Message-Bar-Type Panels: Extruded-aluminum tubes with manufacturer's standard extruded-aluminum fittings installed in each end for attachment to posts. Provide removable top and bottom retainers, locked in place.

1. Tube Size: [**2 by 2 inches**] [**2 by 3 inches**] [**2 by 4 inches**] [**2 by 5 inches**] [**2 by 6 inches**].
2. Panel Finish: [**Baked enamel**] [**Class I, color anodic coating**] [**High-performance organic coating**].

2.7 GRAPHICS

A. Surface-Applied, Die-Cut Vinyl Copy: Provide die-cut characters from nonreflective vinyl film with pressure-sensitive adhesive backing. Apply copy to exposed face of sign panel.

B. Surface-Applied Cutout Characters: Cut copy characters from solid material of thickness indicated. Produce precisely cut characters with square-cut, smooth edges. Apply to exposed face of sign panel with concealed fasteners.

1. Material: [**1/4-inch- thick aluminum plate**] [**1/8-inch- thick, matte-finished, opaque acrylic sheet**].

C. Subsurface Copy: Apply copy to back of face panel by process indicated to produce precisely formed opaque images, free from rough edges.

1. Use reverse silk-screen process to print copy; overspray copy with opaque background-color coating.
2. Use DuPont's "Chromalin" heat- and pressure-laminated photopolymer film system to form copy and background color.

D. Cutout Copy: Machine cut letters, numbers, symbols, and other graphic devices through sign panel to produce precisely formed copy. Use high-speed cutters mechanically linked to master templates in pantographic system or equivalent process capable of producing characters of style indicated with sharply formed edges.

1. Backup for Cutout Copy: 0.125-inch- thick, translucent, [**acrylic**] [**polycarbonate**]-sheet backup attached to back side of panel.
2. Projecting Characters: Precise-fitting copy cut from 0.250-inch- thick, [**transparent**] [**opaque**], acrylic sheet projecting through engraved copy and chemically welded to acrylic backup.
3. Backup for Cutout Copy with Projecting Characters: 0.125-inch- thick, acrylic-sheet backup attached to back side of panel.

E. Copy Embedded in Fiberglass Panels: Apply computer-generated adhesive graphics to panel as masking material. Apply acrylic polyurethane background-color flood coats, 0.015-inch minimum thickness. Include UV inhibitors. Remove masking material.

2.8 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: [**Light bronze**] [**Medium bronze**] [**Dark bronze**] [**Black**].
2. Color: [**Match Architect's sample**] [**As selected by Architect from the full range of industry colors and color densities**].

E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.

2. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

F. High-Performance Organic Coating Finish (Fluoropolymer Two-Coat System): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions and AAMA [**2604**] [**2605**].

G. High-Performance Organic Coating Finish (Fluoropolymer Three-Coat System): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: Manufacturer's standard three-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions and AAMA 2605.

1. Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

2.9 GALVANIZED STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for posts to diameters and spacing indicated.

B. Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for each post to minimum diameter recommended by sign manufacturer, but at least four times the largest post cross-section.

1. Excavate hole depths approximately 39 inches below finished grade.

C. Setting [**Posts**] [**Inserts**]: Center and align [**posts**] [**inserts**] in holes 3 inches above bottom of excavation.

1. Protect portion of [**posts**] [**inserts**] above ground from concrete splatter. Place concrete and vibrate or tamp for consolidation. Check [**posts**] [**inserts**] for alignment and hold in position until concrete has achieved its initial set.

D. Set anchor bolts and other embedded items required for installation. Use templates furnished by suppliers of items to be attached.

E. Install signs level, plumb, and at height indicated, with surfaces free from distortion or other defects in appearance.

3.2 CLEANING

A. At completion of installation, clean soiled surfaces of sign units according to manufacturer's written instructions.

END OF SECTION 10436

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:

   a. Portable fire extinguishers.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.
2. Division 9 painting Sections for field painting fire-protection cabinets.
3. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.
4. Division 16 Section "Interior Lighting" for fire extinguisher location lights.
5. Division 16 Sections for low-voltage wiring for fire-protection cabinet alarms.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.
2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
3. Show location of knockouts for hose valves.

B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.

C. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 SEQUENCING

A. Apply decals on field-painted fire-protection cabinets after painting is complete.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six 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 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.3 PORTABLE FIRE EXTINGUISHERS

A. Available Manufacturers:

1. Amerex Corporation.
2. Ansul Incorporated.
3. Badger Fire Protection.
4. Buckeye Fire Equipment Company.
5. Fire End & Croker Corporation.
6. General Fire Extinguisher Corporation.
7. JL Industries, Inc.
8. Kidde Fyrnetics.
9. Larsen's Manufacturing Company.
10. Modern Metal Products; Div. of Technico.
11. Moon American.
12. Potter Roemer; Div. of Smith Industries, Inc.
13. Watrous; Div. of American Specialties, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Wet-Chemical Type **FE-1**: UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium acetate, potassium citrate or potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.

D. Regular Dry-Chemical Type in Steel Container **FE-2**: UL-rated 10-B:C, 5-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.

E. Multipurpose Dry-Chemical Type in Steel Container **FE-3**: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

F. Purple-K Dry-Chemical Type in Aluminum Container **FE-4**: UL-rated 30-B:C, 5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.4 FIRE-PROTECTION CABINET: **FEC**

A. Basis-of-Design Product: Potter Roemer; Div. of Smith Industries, Inc. or a comparable product by one of the following:

B. Manufacturers:

1. Fire End & Croker Corporation.
2. General Accessory Mfg. Co.
3. JL Industries, Inc.
4. Kidde Fyrnetics.
5. Larsen's Manufacturing Company.

6. Modern Metal Products; Div. of Technico.
7. Moon American.
8. Potter Roemer; Div. of Smith Industries, Inc.
9. Watrous; Div. of American Specialties, Inc.

C. Cabinet Type: Suitable for fire extinguisher.

D. Cabinet Construction: Nonrated.

E. Cabinet Material: Enameled-steel sheet.

F. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

G. Door Glazing: Tempered break glass.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

I. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cylinder lock, keyed alike to other cabinets.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Decals.
3) Lettering Color: Red.
4) Orientation: Vertical.

J. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Exterior of cabinet door trim, door, and trim, except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.

2.5 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

    a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinets: As indicated on drawings.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10520

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Underlavatory guards.
2. Handrails.
3. Robe Hooks

B. Related Sections include the following:

1. Division 8 Section "Mirrored Glass" for frameless mirrors.
2. Division 10 Section "Toilet Compartments" for compartments and screens.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

1. Toilet and Bath Accessories:

a. A & J Washroom Accessories, Inc.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. General Accessory Manufacturing Co. (GAMCO).
f. McKinney/Parker Washroom Accessories Corp.

2. Underlavatory Guards:

a. Brocar Products, Inc.
b. Truebro, Inc.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

F. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. BA-1: Utility shelf with mop holder and rag holder:

1. Products: Provide one of the following: AMERICAN SPECIALITES, or approved equal.

B. BA-2: 30” 1 ½” dia. Stainless Steel Concealed Mount Grab Bar:

1. Products: Provide one of the following: AMERICAN SPECIALTIES, Model #3200

C. BA-3: 36” 1 ½” dia. Stainless Steel Concealed Mount Grab Bar:

1. Products: Provide one of the following: AMERICAN SPECIALTIES, Model #3200

D. BA-4: 42” 1 ½” dia. Stainless Steel Concealed Mount Grab Bar:

1. Products: Provide one of the following: AMERICAN SPECIALTIES, Model #3200

E. BA-5: 48” 1 ½” dia. Stainless Steel Concealed Mount Grab Bar:

1. Products: Provide one of the following: AMERICAN SPECIALTIES, Model #3200

F. BA-6: 24” x 48” Channel Frame Mirror Unit: Where this designation is indicated, provide mirror unit complying with the following:

1. Available products include the following: Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.
2. Products: Provide one of the following: AMERICAN SPECIALTIES, Model #0620 Series

G. BA-7: Single Robe Hook:

H.

1. Products: Provide one of the following: AMERICAN SPECIALITES, model 7340, or approved equal.

END OF SECTION 10801

SECTION 12356 - KITCHEN CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood-faced kitchen cabinets.
2. Plastic-laminate countertops.

B. Related Sections include the following:

1. Division 11 Section "Residential Appliances" for appliances mounted in kitchen casework.
2. Division 15 Section "Plumbing Fixtures" for sink units mounted in countertops.

1.3 DEFINITIONS

A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets.

B. Semiexposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."

C. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 SUBMITTALS

A. Product Data: For the following:

1. Cabinets.
2. Plastic-laminate countertops.
3. Cabinet hardware.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.

D. Samples for Verification: For the following materials; in sets showing the full range of color, texture, and pattern variations expected:

1. Wood-veneered panels with transparent finish, 8 by 10 inches, for each species.
2. Solid wood with transparent finish, 50 sq. in., for each species.
3. Plastic laminate for countertops, 8 by 10 inches.
4. One unit of each type of exposed hardware.

E. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Substitutions."

C. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.

2. Plastic-Laminate Countertops: KCMA A161.2.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install kitchen casework until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where kitchen casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of kitchen casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cabinets:
   a. A qualified cabinet millwork shop with at least 5 years experience constructing cabinet types as detailed on the drawings. Final qualification and selection of the millwork supplier will be by the owner and architect after review company interview, review of their portfolio and company capacity.
   b. Owner reserves the right to reject any cabinet manufacturers.

2. Plastic Laminate for Countertops:

   a. Formica Corp.
   b. Laminart.
   c. Nevamar Corp.
   d. Wilsonart International; Div. of Premark International, Inc.

2.2 COLORS, TEXTURES, AND PATTERNS

A. Colors, Textures, and Patterns: Match Architect's samples.

2.3 CABINET MATERIALS

A. Exposed Materials: Comply with the following:

1. Exposed Wood Species: As Indicated on Drawings. Do not use two adjacent exposed faces that are noticeably dissimilar in color, grain, figure, or natural character markings.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.
3. Plywood: Hardwood plywood complying with HPVA HP-1 with face veneer of species indicated, selected for compatible color and grain with Grade A faces and Grade C backs of same species as faces.

   a. Edge band exposed edges with minimum 1/8-inch- thick, solid-wood edging of same species as face veneer.

4. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

   a. Where edges of solid-color plastic-laminate sheets will be visible after fabrication, provide through-color plastic laminate.

5. PVC Edge Molding: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, and 1 mm thick elsewhere.
6. Vinyl-Faced Fiberboard: Medium-density fiberboard complying with ANSI A208.2, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.

B. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects and kiln dried to 7 percent moisture content. Stained to be compatible with exposed surfaces.
2. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces stained to be compatible with exposed surfaces and Grade 3 backs of same species as faces.

3. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

C. Concealed Materials: Comply with the following:

1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.

2.4 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
1. Grade: HGP.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded.

D. Solid Wood Edges and Trim: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.

1. Wood Species: As Indicated on Drawings.

2.5 CASEWORK HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, material, size, and finish as selected from manufacturer's standard choices.

B. Hinges: Concealed hinges, self-closing..

C. Drawer slides – side mount, 75 lb. load capacity, epoxy coated, self-closing, and complying with BHMA A156.9, Type B05091.

D. Door pull and other hardware: As indicated on Drawings.

2.6 CABINET CONSTRUCTION

A. Face Frames: mortise and tenon, glued and fastened, horizontal rails ¾” x 1-1/2” kiln dried hardwood, vertical stiles ¾” x 1-1/2” kiln dried hardwood.

B. Door and Drawer Fronts: 7/16” fiberboard basecoated, printed, topcoated (4 sides), bottom 1/8” hardboard, matches interior, sides rabbet joint machined all four (4) corners with all joints being glued and power nailed.

C. Exposed Cabinet Ends: exposed ends ½” 45# premium particle board.

D. Cabinet Ends: all wall cabinet ends rabbeted to receive tops and bottoms, base cabinet ends are rabbeted to receive floor and shelf.

E. Cabinet Tops and Bottoms: wall cabinet not less than ½” 45# particle board, material let into sides and face frame. All joints glued and power nailed.

F. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.

G. Wall-Hung Unit Back Panels: all back are 1/8" standard hardboard.

H. Base Unit Back Panels: all back are 1/8" standard hardboard

I. Front Frame Drawer Rails: 3/4-by-1-1/4-inch solid wood mortised and fastened into face frame.

J. Cabinet Doors and Drawer Heads: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Doors – Five piece oak square frame door with solid oak plywood center panel.
2. All joints are tennoned and coped, profile: square.
3. Drawer heads –solid kiln dried oak – ¾" thick, profile: square.

K. Base Cabinet Floors:

1. Base cabinet not less than ½" 45# particle board.
2. Material let into sides and face frame. All joints glued and power nailed.

L. Shelves: shelving is 5/8" premium particle board with front edge smooth, fully adjustable, base shelf is half depth 5/8" premium particle board with front edge smooth, fully adjustable, due to plumbing, there is no shelving in sink base.

M. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

N. Factory Finishing: Conversion varnish – a hard durable finish that is non-yellowing (ANSI 161.1). To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. Configuration: As detailed on Drawings.
1. Front: As indicated.
2. Cove: Where indicated.
3. Backsplash: As indicated.
4. End Splash: As Indicated.

B. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch thick.

1. For countertops at sinks and lavatories, use phenolic-resin particleboard or exterior-grade plywood.
2. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of particleboard laminated to top.

C. Paper Backing: Provide paper backing on underside of countertop substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install casework with no variations in flushness of adjoining surfaces; use 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 doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.

F. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.2 ADJUSTING AND CLEANING

A. Adjust casework and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 12356

SECTION 12484 - FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Carpet-type mats.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.
2. Division 9 Section "Carpet" for tufted and woven carpet and cushions.
3. Division 12 Section "Foot Grilles" for rigid foot grilles and frames.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's specifications and installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of floor mat and frame specified.

B. Shop Drawings: For floor mats and frames. Show assembly, joint locations, installation details, layout, plans, elevations, sections, details of patterns or designs, accessories, anchors, and attachments to other Work.

1. Coordinate Shop Drawings showing oversized recess for deferred installation of frames with concrete work.

C. Samples for Initial Selection: For each type of floor mat and frame indicated.

D. Maintenance Data: For cleaning and maintaining floor mats to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." Sections 302 and 303 in ICC A117.1.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify blocked-out openings in floors by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating floor mats and frames without field measurements. Coordinate floor construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate size and location of oversized recesses in concrete work to receive floor mats and frames. Defer frame installations until building enclosure is completed and related interior finish work is in progress. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate integral installation of recessed frames and anchors with placing of concrete slab so frames are positioned accurately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpet-Type Mats:

a. AFCO-USA.
b. Arden Architectural Specialties, Inc.
c. Balco, Inc.
d. Bonar Floors.
e. Cactus Mat Manufacturing Co.
f. Consolidated Plastics Company, Inc.
g. Construction Specialties, Inc.
h. Mats Incorporated.
i. Musson, R. C. Rubber Co. (The).
j. Pawling Corporation.
k. Sbenco International, Inc.
l. Tennessee Mat Company, Inc.

2.2 METAL FRAME MATERIALS

A. Extruded Aluminum: ASTM B 221, alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.3 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete materials complying with Division 3 for grout and fill around and under recessed mats and frames that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FLOOR MATS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

1. Provide mats with custom inlaid or woven-in graphic design, or other graphic as indicated.

B. Carpet-Type Mats: Nylon carpet bonded to 1/8- to 1/4-inch- thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.

2.5 FABRICATION

A. General: Where possible, verify sizes by field measurement before shop fabrication.

B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

C. Recessed Metal Mat Frames: Extruded aluminum, of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, floor conditions, and floor recesses for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

1. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
2. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
3. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION 12484

SPECIFICATION INDEX

15010	General Mechanical Requirements
15060	Hangers and Supports
15075	Mechanical Identification
15080	Mechanical Insulation
15110	Valves
15120	Piping Specialties
15140	Domestic Water Piping
15150	Sanitary Waste and Vent Piping
15160	Storm Drainage Piping
15190	Fuel Piping
15410	Plumbing Fixtures
15480	Domestic Water heaters
15550	Breeching Chimneys and Stacks
15736	Packaged Rooftop Air Conditioning Units
15738	Split-System Air-Conditioning Units
15810	Ducts
15820	Duct Accessories
15830	Fans
15855	Diffusers, Registers and Grilles
15905	HVAC Instrumentation
15940	Sequence of Operation
15950	Testing, Adjusting, and Balancing

CAMP WILLIAMS: JLTC- Building #4

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. The work includes, but is not limited to the following:

1. Basic requirements common to the work in general of Division 15 and other Divisions and Sections of the specification where referenced.

2. Provide, unless specified otherwise, all labor, materials and equipment necessary for completely finished and operational mechanical systems described and specified under other sections of this Division 15.

3. Provide all minor incidental items such as offsets, fittings, and accessories required as part of the work even though not specified or indicated.

4. Inspection: Inspect work preceding or interfacing with work of Division 15 and report any known or observed defects that affect the work to the General Contractor. Do not proceed with the work until defects are corrected.

1.01 REGULATORY REQUIREMENTS

A. Execute work per Underwriters, Public Utility, Local and State Codes, Ordinances and applicable regulations. Obtain and pay for required permits, inspections, utility service connections, meters, and certificates. Notify Architect of items not meeting said requirements.

B. All contractors shall comply with latest editions of all applicable codes, ordinances and regulations in effect at the time of bid opening including but not necessarily limited to the following:

State and Federal Energy Conservation Standards
Utility Company Requirements
Jurisdictional Building Code
Jurisdictional Mechanical Code
Jurisdictional Plumbing Code

C. If discrepancies occur between the Contract Documents and any applicable codes, ordinances, acts, or standards, the most stringent requirements shall apply.

D. Where hourly fire ratings are indicated or required, provide components and assemblies meeting requirements of the American Insurance Association, Factory Mutual Insurance Association and listed by Underwriters Laboratories, Inc.

1.03 COORDINATION

A. General: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.

1. Before any equipment is purchased or fabricated and before running and/or fabricating any lines of piping or ductwork, the General Contractor, and his subcontractors shall assure themselves that they

can be run as contemplated. Because of the small scale of the drawings, it is not possible to indicate all offsets, fitting, and accessories that may be required. The General Contractor and his Subcontractors shall carefully investigate all mechanical, electrical and structural drawings, and civil drawings along with the finish conditions affecting all of their work, furnishing any required fittings, valves, duct transitions, offsets and accessories as may be required to meet such conditions, at no additional cost.

B. Coordination with Electrical Work: Refer to Architectural Section.

C. Utility Interruptions: Coordinate mechanical utility interruptions with the Owner and the Utility Company. Plan work so that duration of the interruption is kept to a minimum.

D. Cutting and Patching: Section 15015.

E. Drawings and Specifications: The Mechanical Drawings indicate the general design and arrangement of lines, equipment, systems, etc. Information shown is diagrammatic in character and does not necessarily indicate every required offset, fitting, etc. Do not scale the Drawings for dimensions. Take dimensions, measurements, locations, levels, etc., from the Architectural Drawings and equipment to be furnished.

F. Discrepancies: Examine Drawings and Specifications for other parts of the work, and if any discrepancies occur between the plans for the work of this Division and the plans for the work of others, report such discrepancies to the General Contractor and obtain written instructions for any changes necessary.

G. Order of Precedence: The precedence of mechanical construction documents are as follows:

1. Addenda and modifications to the Drawings and Specifications take precedence over the original Drawings and Specifications.

2. Should there be a conflict within the Specifications or within Drawings of the same scale, the more stringent or higher quality requirements shall apply.

3. In the Drawings, the precedence shall be Drawings of larger scale over those of smaller scale, figured dimensions over scaled dimensions and noted materials over graphic indications.

4. Should a conflict arise between the Drawings and the Specifications, the Specifications shall have precedence.

5. Should there be a conflict in dimensions or locations between mechanical drawings and architectural drawings, the architectural drawings shall have precedence.

1.05 PROJECT RECORD DOCUMENTS

A. General: Comply with Division 1.

B. Job Site Documents: Maintain at the job site, one record copy of the following:

1. Drawings

2. Specifications

3. Addenda

4. Reviewed Shop Drawings

5. Field Test

6. Records Do not use record documents for construction purposes. Maintain documents in clean, dry legible condition, apart from documents used for construction.

C. Record Information: Label each document "Record Document". Mark information with contrasting color using ink. Keep each record current. Do not permanently conceal any work until required information is recorded.

D. Record following information on Drawings:

1. Horizontal and vertical location of underground utilities.

2. Location of internal utilities and appurtenances concealed in construction.

3. Field changes of dimension and detail.

4. Changes by change order or field order.

5. Details not on original contract drawings.

E. Record the following information on Specifications.

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes by change order or field order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain shop drawings as record documents recording changes made after review as specified for drawings above.

G. Submittal: At completion of project, deliver record documents to General Contractor.

1.06 FIELD ENGINEERING

A. Accessibility:

1. Division 15 Contractor shall be responsible for the sufficiency of the size of shafts and chases and the adequate clearance in double partitions and hung ceilings for proper installation of his work. He shall cooperate with Contractors of other Divisions of the Work whose work is in the same space and shall advise the General Contractor of his requirements. Such spaces and clearances shall, however, be kept to the minimum size required.

2. Division 15 Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include (but not be limited to valves, shock absorbers, traps, cleanouts, motors, controllers, switchgear, and drain points). If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be allowed to provide for better accessibility. Any changes shall be approved by the Architect prior to making the change.

3. Division 15 Contractor shall provide the General Contractor with the exact locations of access doors for each concealed valve, shock absorber control, damper, or other device requiring service. Locations of these doors shall be submitted in sufficient time to be installed in the normal course of work.

B. Freeze Protection:

1. Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.

C. Scaffolding, Rigging and Hoisting:

1. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required.

1.07 ABBREVIATIONS AND DEFINITIONS

A. Specification Language Explanation: These Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of words of phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "a", "the", are intentional. Supply omitted words or phrases by inference in same manner as they are when "NOTE" occurs on Drawings. Supply words "shall be" or "shall" by inference when colon is used with sentences or phrases. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

B. Definitions:

1. "Provide" means Contractor is responsible for the furnishing and installation of.

1.08 REFERENCE STANDARDS

A. References:

1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

2. The date of the standard is that in effect as the bid date, or date of Owner/Contractor Agreement when there are no bids, except when a specific date is specified.

3. When required by individual Specifications section, obtain copy of standard. Maintain copy at job site during work until substantial completion.

B. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

ADC Air Diffusion Council
435 North Michigan Avenue
Chicago, IL 60611

AGA American Gas Association
1515 Wilson Boulevard
Arlington, VA 22209

AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ARI Air Conditioning and Refrigeration Institute
1815 North Fort Meyer Drive
Arlington, VA 22209

ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
345 East 47th Street
New York, NY 10017

ASME American Society of Mechanical Engineers
345 East 45th Street
New York, NY 10017

ASPE American Society of Plumbing Engineers
15233 Ventura Boulevard, Suite 811
Sherman Oaks, CA 91403

ASSE American Society of Sanitary Engineer
960 Illuminating Building
Cleveland, OH 44113

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWS American Welding Society
2501 NW Seventh Street
Miami, FL 33125

CISPI Cast Iron Soil Pipe Institute
1499 Chain Bridge Road
McLean, VA 22101

FM Factory Mutual System
1151 Boston-Providence Turnpike
Norwood, MA 02062

NAHB National Association of Home Builders
Research Foundation, Inc.
P.O. Box 1627
Rockville, Maryland 20850

NBFU National Board of Fire Underwriters

NBS National Bureau of Standards
Washington, D.C. 20234

NCPWB National Certified Pipe Welding Bureau
5530 Wisconsin Avenue, Suite 750
Chevy Chase, Maryland 20815

NEC National Electric Code (of NFPA)

NEMA National Electrical Manufacturer's Association
2101 L Street, NW
Washington, DC 20037

NFPA National Fire Protection Association
Batterymarch Park
Quiney, MA 02269

NSF National Sanitation Foundation
Box 1468
Ann Arbor, MI 48106

PDI Plumbing and Drainage Institute
5342 Boulevard Place
Indianapolis, Indiana 46208

SMACNA Sheet Metal and Air Conditioning Contractor's
National Association
8224 Old Courthouse Road
Vienna, VA 22180

UL Underwriters Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

1.09 SUBMITTALS

A. Submit samples, shop drawings and product data as required by various sections of Division 15 in accordance with The General Conditions of the Contract.

B. Test Reports: Submit certified test reports showing compliance in accordance with General Conditions of the Contract.

C. Operating Instructions and Maintenance Data: Submit printed operating instructions and maintenance data in accordance with Operating and Maintenance Data paragraph in this Section.

1.10 QUALITY ASSURANCE

A. Quality Control:

1. Materials and apparatus required for the work to be new and of first-class quality; to be furnished, delivered, erected, connected and finished in every detail; and to be so selected and arranged so as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article shall be furnished.

2. Furnish the services of an experienced superintendent, who will be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, certified welders, plumbers, millwrights, sprinkler fitters, drain layers, helpers, and labor required to unload, transfer, erect, connect, adjust, start, operate and test for each system.

3. Unless otherwise specifically indicated, equipment and materials to be installed in accordance with the recommendations of the manufacturer. This includes the performance of tests as recommended by the manufacturer.

1.11 DELIVERY, STORAGE AND HANDLING

A. General: Deliver and store materials and equipment in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class, grade, size and color.

B. Protection: Store materials and equipment off the ground and under cover, protected from damage.

C. Large Items: Make arrangements with other contractors on the job for introduction into the building of equipment too large to pass through finished openings.

D. Handling of Materials: Materials shall be handled, sorted and distributed using appropriate handling methods to protect all materials from damage. Damaged, rusted, corroded or otherwise damaged materials shall be removed from the project site. Determination of materials deemed unusable or inappropriate for installation shall be made by the Architect/Engineer.

1.12 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Substitutions: Comply with Division 1

B. Some materials and equipment are specified by manufacturer and catalog numbers. The manufacturer and catalog numbers are used to establish a degree of quality and type for such equipment and material.

C. When alternate or substitute materials and equipment are used, be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, electrical changes and other apparatus and trades that may be affected by their use.

1.13 CLEANING AND FINISHING

A. Provide cleaning in accordance with the General Conditions of the Contract.

B. Cleaning shall include but not be limited to removing grease, dirt, dust, stains, labels, fingerprints and other foreign materials from sight-exposed piping, ductwork, equipment, fixtures and other such items installed under Division 15 of the work. If finishes have been damaged, refinish to original condition and leave everything in proper working order and of intended appearance.

1.14 START-UP PROCEDURES

A. Before start-up, each piece of equipment comprising a part of the system shall be checked for proper lubrication, drive rotation, belt tension, proper control sequence, and any other condition which may cause damage to equipment or endanger personnel.

B. Insure that all control systems are fully operational in automatic mode.

C. If systems are not to continue in use following the start-up procedures, steps should be taken to insure against accidental operation or operation by unauthorized personnel.

D. Factory personnel shall be notified as appropriate to start systems requiring their services.

E. Notify Architect prior to start-up of all major mechanical equipment and systems.

1.15 SCHEDULE OF TESTING

A. Provide testing in accordance with the General Conditions of the Contract.

B. A schedule of testing shall be drawn up by the Mechanical Contractor in such a manner that it will show areas tested, test pressure, length of test, date, time and signature of testing personnel.

C. All testing must be performed in the presence of the General Contractor's representative; his signature for verification of the test must appear on the schedule.

D. All testing must be performed in accord with the procedures set forth in Division 15 and other sections of the specifications where referenced. At completion of testing, the schedule shall then be submitted in triplicate to the Architect.

E. Make all specified tests on piping, ductwork and related systems as necessary.

F. Make sure operational and performance tests are made on seasonal equipment.

G. Complete all tests required by Code Authorities, such as smoke detection, life safety, fire protection and health codes.

H. After test runs have been completed and systems have been demonstrated to be satisfactory and ready for permanent operation, all permanent pipeline strainers and filters shall be cleaned, air filters cleaned

or replaced, valve and pump packings properly adjusted, belt tensions adjusted, drive guards secured in place, lubrication checked and replenished if required.

1.16 OPERATING AND MAINTENANCE DATA

A. Division 15 Contractor shall submit three (3) typed and bound copies of the maintenance manual, 8-1/2" x 11" in size, to the Mechanical Consulting Engineer for their approval. These approved copies shall then be transmitted to the Owner.

B. The manual shall be enclosed in a stiff-back, three-ring binder and shall have:

1. Alphabetical list of all system components including the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year's operation.

2. Operating instructions for complete system, including emergency procedures for fire or failure of major equipment and procedures for normal starting/operating/shutdown and long-term shutdown.

3. Maintenance instructions, including valves, valve tag and other identified equipment lists, proper lubricants and lubricating instructions for each piece of equipment and necessary cleaning/replacing/adjusting schedules.

4. Manufacturer's data on each piece of equipment, including:

a. Installation instructions.

b. Drawings and specifications (approved shop drawings).

c. Parts lists.

d. Complete wiring and temperature control diagrams. (Approved shop drawings).

C. In addition to the maintenance manual, and keyed to it, the equipment shall be identified and tagged as specified elsewhere. Insert a copy.

1. Identify all starters, disconnect switches, and manually operated controls, except integral equipment switches with permanently applied, legible markers corresponding to operating instructions in the "Maintenance Manual".

2. Tag all manual operating valves with 1-1/2" diameter brass tags attached with chains. Tags are to be sequence numbered with legible metal stamps.

3. Provide a typed tag list or schedule mounted under glass in the equipment room stating number, location, and function of each tagged item. Insert a copy of tag list in each "Maintenance Manual".

D. Division 15 Contractor shall be responsible for scheduling instructional meetings for maintenance personnel on the proper operation and maintenance of all mechanical systems, using the maintenance manual as a guide. These meetings must be scheduled through the Architect, and far enough in advance so that all personnel can be notified.

1.17 OPERATING AND MAINTENANCE DATA ON CD-ROM

A. An intuitive CD-ROM instructional manual shall be provided to give the owners representative the information they need to care, adjust, maintain and operate all of the equipment within the building , to include but not limited to, the heating, air conditioning, ventilating, plumbing automatic temperature control systems, kitchen equipment, stage and theatrical equipment, electrical equipment and building products requiring maintenance.

B. CD-ROM manual preparation shall be under the direction of an individual or organization that has demonstrated expertise in the preparation of a comprehensive and complete CD-ROM operation and maintenance manual. Qualifications shall be submitted for approval.

C. All CD-ROM's shall be authored with Adobe Acrobat. The authoring shall, but not be limited to include the following:

a) All design drawings and documentation shall be included on the CD-ROM in a PDF format. These drawings shall be provided in an electronic format to the company contracted to create the CD-ROM and shall include the civil engineering, architectural, structural, electrical and mechanical sections

b) Icons shall be located on the PDF plans to link test and balance reports and mechanical operation and maintenance information to the design drawings.

c) All information on the CD-ROM shall be printable on 8.5" x 11" plain paper with the design drawings and automatic temperature control drawings printable on plain paper.

d) Linked information such that the user can key word search for information.

e) Provide a hyper-text alphabetical index of all equipment and building products as outlined in item 1 above.

f) Use of multimedia formatting (text, pictures, graphics and sound etc.) will be used to make the information more accessible and understandable.

g) All documentation shall be converted to an unchangeable Portable Document Format (.PDF).

h) The CD-ROM shall start automatically when inserted in the drive under the Windows or higher operation system. Any directions to continue will be observable on the screen.

I) Operation and maintenance information to be supplied to the company contracted to do the CD-ROM by the contractor and suppliers providing the materials and equipment.

D. At the beginning or start-up of the CD-ROM there shall be a General Information index screen to direct

the user to the portion of the manual desired. This index screen will consist of five (5) major groups. The groups will include:

a) Names of architects, engineers and contractors with address and telephone number.

b) Warranties List: This section to include:

c) A list of all the contractors with a link to their warranty for their part of the job.

d) Design drawings

E) Manufacturer's Operation and Maintenance Manuals:

a) Architectural or General Contractor section:

b) Kitchen Section:

c) Mechanical section:

d) Electrical section:

F. The company selected to produce the CD-ROM is to insure that there is a computer at the job site. If there is not a computer available on the site one should be provided.

a) The minimum computer requirements to run the CD-ROM will be the following:

- Pentium Processor 100 Mhz
- 16 Meg RAM
- 4x CD-ROM drive
- Sound Card
- 64 bit 2 meg video card
- Windows 95/98
- Mouse
- SVGA monitor
- Monitor set to 800 x 600 resolution

7. Four (4) copies of the CD will provided to the owner's representative and one copy to the Mechanical Engineer.

1.18 WARRANTIES

A. Warranty: Provide a written warranty to the Owner covering the entire mechanical work to be free from defective materials, equipment and workmanship for a period of one year after Date of Acceptance. During this period provide labor and materials as required to repair or replace defects at no additional cost to the Owner. Provide certificates for such items of equipment which have warranties in excess of one year. Submit to the General Contractor.

B. This warranty will be superceded by the terms of any specific equipment warranties or warranty modifications resulting from use of equipment for construction heat or ventilation. This warranty may be voided by improper owner maintenance.

1.19 CERTIFICATES AND KEYS

A. Certificates: Upon completion of the work, deliver to the General Contractor one copy of Certificate of Final Inspection.

B. Keys: Upon completion of work, submit keys for mechanical equipment, panels, etc. to the General Contractor.

1.20 REPORTS

A. Following are items to be submitted to the Owner and Architect/Engineer for review prior to substantial completion.

1. Plumbing Disinfectant Reports
2. Air Balance Reports
3. Duct Pressure Test Reports

END OF SECTION 15010

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Firestopping relating to mechanical work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of inserts or sleeves in concrete forms specified by this section.
2. Section 03300 - Cast-in-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Section Installation requirements for roof flashing installation.
4. Section 07840 - Firestopping: Product requirements for firestopping for placement by this section.
5. Section 07900 - Joint Sealers: Product requirements for sealant materials for placement by this section.
6. Section 09900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
7. Section 15070 - Mechanical Sound, Vibration, and Seismic Control: Product and execution requirements for vibration isolators.
8. Section 15105 - Pipes and Tubes: Execution requirements for placement of hangers and supports specified by this section.
9. Section 15140 - Domestic Water Piping: Execution requirements for placement of hangers and supports specified by this section.
10. Section 15150 - Sanitary Waste and Vent Piping: Execution requirements for placement of hangers and supports specified by this section.
11. Section 15160 - Storm Drainage Piping: Execution requirements for placement of hangers and supports specified by this section.
12. Section 15195 - Gas Piping: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. American Society for Testing and Materials:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. Factory Mutual System:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

G. Warnock Hersey:
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit calculations sealed by a registered professional engineer.

F. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Carpenter & Paterson Inc..
2. Creative Systems Inc.
3. Glope Pipe Hanger Products Inc
4. Michigan Hanger Co..
5. Superior Valve Co
6. Substitutions: Section 01600 - Product Requirements.

B. Plumbing Piping - DWV:
1. Conform to ASME B31.9
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): [Malleable iron] [Carbon steel], adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches (50 mm) and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches (75 mm) and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches (100 mm) and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): [Malleable iron] [Carbon steel], adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.

5. Wall Support for Pipe Sizes 3 inches (76 mm) and Smaller: Cast iron hook.
6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
7. Floor Support for Hot Pipe Sizes 4 inches (100 mm) and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft (24.5 kg/sq m) sheet lead
2. Soundproofing: 1 lb./sq. ft (5 kg/sq m) sheet lead.

D. Flexible Flashing: 47 mil thick sheet buty compatible with roofing.

E. Caps: Steel, 22 gage (0.8 mm) minimum at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Fabrication: Welded 18 gage (1.2 mm) galvanized steel shell and base, mitered 3 inch (75 mm) cant, variable step to match root insulation, 1-1/2 inch (38 mm) thick insulation, factory installed wood nailer.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel.

2.7 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. [Thunderline Link-Seal, Inc
2. [NMP Corporation] Model
3. Substitutions: Section 01600 - Product Requirements

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp..
2. Fire Trak Corp..
3. Hilti Corp..
4. International Protective Coating Corp..
5. 3M fire Protection Products
6. Substitutions: Section 01600 - Product Requirements

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard
   2. Mineral fiber matting.
   3. Sheet metal.
   4. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
   2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches (100 mm) and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

D. Place hangers within 12 inches (300 mm) of each horizontal elbow.

E. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

G. Support vertical piping at every [other] floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping]

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches (87 mm) thick and extending 6 inches (150 mm) beyond supported Refer to Section 03300.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 15070.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches (75 mm) minimum above finished roof surface with lead worked 1 inch (25 mm) minimum into hub, 8 inches (200 mm) minimum clear on sides with 24 x 24 inches (600 x 600 mm) sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches (250 mm) clear on sides with minimum 36 x 36 inch (910 x 910 mm) sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower mop. sink drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

F. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Fire Rated Surface:
1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

F. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening] as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

A. Section 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Section 01700 - Execution Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

PIPE HANGER SPACING

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches (mm)	Feet (m)	Inches (mm)
1/2 (12)	7 (2.1)	3/8 (9)
3/4 (20)	7 (2.1)	3/8 (9)
1 (25)	7 (2.1)	3/8 (9)
1-1/4 (32)	7 (2.1)	3/8 (9)
1-1/2 (38)	9 (2.7)	3/8 (9)
2 (50)	10 (3)	3/8 (9)
2-1/2 (65)	11 (3.4)	1/2 (13)
3 (75)	12 (3.7)	1/2 (13)
4 (100)	14 (4.3)	5/8 (15)
5 (125)	16 (4.9)	5/8 (15)
6 (150)	17 (5.2)	3/4 (19)
Spigot (or No-Hub) And at Joints	5 (1.5)	5/8 (15)

END OF SECTION 15060

SECTION 15075 -MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Pipe markers.
3. Labels.

B. Related Sections:
1. Section 09900 - Paints and Coatings: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer..

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
1. Craftmark Identification Systems
2. Safety Sign Co.
3. Seton Identification Products

B. Substitutions: Section 01600 - Product Requirements

C. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:
1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

2.3 LABELS

A. Description: Laminated Mylar, size 1.9 x 0.75 inches (48 x 19 mm), adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09900 for stencil painting.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Identify control panels and major control components outside panels with plastic nameplates.

E. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

3.3 SCHEDULES

IDENTIFICATION

1. Natural Gas Piping.
   a. Identification Type:
   b. Background Size:
   c. Background Color:
   d. Lettering Size:
   e. Lettering Color:
2. Domestic Cold Water Piping.
   a. Identification Type:
   b. Background Color:
   c. Lettering Size:
   d. Lettering Color:
3. Domestic Hot Water.
   a. Identification Type:
   b. Background Color:
   c. Lettering Size:
   d. Lettering Color:

END OF SECTION 15075

SECTION 15080 - MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ductwork insulation.
2. Duct liner.
3. Insulation jackets.
4. Equipment insulation
5. Breeching insulation.
6. Piping system insulation.
7. Insulation accessories including vapor retarders, jackets, and accessories.

B. Related Sections:
1. Section 07840- Firestopping: Product requirements for firestopping for placement by this section.
2. Section 09900 - Paints and Coatings: Execution requirements for painting insulation jackets and covering specified by this section.
3. Section 15060 - Hangers and Supports: Product and Execution requirements for inserts at hanger locations.
4. Section 15075 - Mechanical Identification: Product requirements for mechanical identification.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
4. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
5. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
6. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
7. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
9. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
10. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
11. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
12. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
15. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
16. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
17. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
18. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
19. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
20. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
21. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
22. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
23. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
24. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
25. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
26. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
27. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storaging, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 MAN MADE MINERAL FIBER

A. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I, 850 degrees F (454 degrees C)

B. Vapor Retarder Jacket:
1. [ASTM C921,] White Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

D. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

E. Glass Fiber Fabric:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
3. Weave: 5 x 5.

F. Indoor Vapor Retarder Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Vinyl emulsion type acrylic, compatible with insulation.

2.2 MAN MADE MINERAL FIBER, FLEXIBLE BLANKET OR BATTS

A. Insulation: ASTM C1290; Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
1. Operating Temperatures: 250 degrees F (121 degrees C).
2. Density: 1.5 lb/cu ft (24 kg/cu m).
3. 'K' ('ksi') factor: ASTM C518, 0.25 at 75 degrees F ([0.043] [0.039] [0.036] at 24 degrees C).

B. Vapor Retarder Jacket: ASTM 1136, Type II Flexible and Low Permeance Vapor Retarders for Thermal Insulation.
1. For systems operating at temperatures below ambient, close and secure seams and joints. When outward clinching staples are used, seal penetrations.

C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

D. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

2.3 CELLULAR GLASS

A. Insulation: ASTM C552, Type II - pipe and tubing insulation, Class 2 - Jacketed.
1. 'K' ('ksi') factor: ASTM C177 or ASTM C518, 0.29 at 75 degrees F

2.4 GLASS FIBER DUCT LINER, FLEXIBLE

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type I

B. Adhesive:
1. Waterproof [, ASTM E162 fire-retardant] type.

C. Liner Fasteners: Galvanized steel, self-adhesive pad with integral or press-on head.

2.5 GLASS FIBER DUCT LINER

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type II.

B. Adhesive:
1. Waterproof , ASTM E162 fire-retardant type.

C. Liner Fasteners: Galvanized steel, self-adhesive pad with integral or press-on head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

C. Man made mineral fiber insulated pipes conveying fluids below ambient temperature:
1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

E. Man made mineral fiber insulated pipes conveying fluids above ambient temperature:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:
1. Application: Piping or Equipment 2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under finish jacket.
4. Insert configuration: Minimum 6 inches (150 mm) long, of thickness and contour matching adjoining insulation; may be factory fabricated.
5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.

G. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing

insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07840 for penetrations of assemblies with fire resistance rating greater than one hour.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces [(less than 10 feet (3 meters) above finished floor)]: Finish with canvas jacket sized for finish painting

I. Factory Insulated Equipment: Do not insulate.

J. Exposed Equipment: Locate insulation and cover seams in least visible locations.

K. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

L. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

M. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

N. Mineral fiber insulated equipment containing fluids below ambient temperature: Provide vapor retarder jackets, factory-applied or field-applied. Finish with glass-cloth and vapor barrier adhesive.

O. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

P. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

Q. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

R. External Duct Insulation Application:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

S. Duct Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply:
      a. Cellular Glass Insulation:
         1) Pipe Size Range: 1 to 4 inch .
         2) Thickness: 1 inch .
   2. Domestic Hot Water Re-circulation:
      a. Man Made Mineral Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (25 mm).
      b. Expanded Polyethylene Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch (25 mm).
   3. Tempered Domestic Water Supply:
   4. Tempered Domestic Water Re-circulation:
   5. Domestic Cold Water:
   6. Roof Drain Bodies:
   7. Roof Drainage Above Grade:
   8. Roof Drainage Run Horizontal at Roof Level:
   9. Plumbing Vents Within 10 feet (3 Meters) of Exterior:

B. Plumbing Systems:

C. Exhaust Ducts Within 10 feet (3 m) of Exterior Openings:

D. Supply Ducts:

END OF SECTION 15080

SECTION 15110-VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes valves for building services piping.

1.2 REFERENCES

A. AGA Z21.22 (American Gas Association) - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. ASME B16.3 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.

C. AWS (American Welding Society) - Welding and Brazing Qualifications.

D. MSS SP-71 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

E. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.

F. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit Manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install valves underground when bedding is wet or frozen.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PLUMBING VALVES

2.2 GLOBE VALVES

A. Manufacturers:
1. American Valve
2. FMC Crosby Valve
3. Red-White Valve Corp..
4. Substitutions: Section 01600 - Product Requirements

B. Up To and Including 3 inches (80 mm): MSS SP-80, [Class 125] bronze body, bronze trim, hand-wheel, teflon disc, solder or threaded ends.

2.3 BALL VALVES

A. Manufacturers:
1. American Valve.
2. FMC Crosby Valve.
3. Red-White Valve Corp.
4. Substitutions: Section 01600 - Product Requirements

B. Construction, 4 inches (100 mm) and Smaller: MSS SP-110, [Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

2.4 PLUG VALVES

A. Manufacturers:
1. American Valve.
2. FMC Crosby Valve
3. Red-White Valve Corp..
4. Substitutions: Section 01600 - Product Requirements

B. Construction 2-1/2 inches (65 mm) and Larger: MSS SP-78, [175 psi (1200 kPa) CWP] , cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged ends. Furnish lever operator with setscrew.

2.5 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. American Valve.
2. FMC Crosby Valve.
3. Red-White Valve Corp
4. Substitutions: Section 01600 - Product Requirements

B. Construction: Class 150, bronze body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.6 WATER PRESSURE REDUCING VALVES

A. Up to 2 inches (50 mm):
1. Manufacturers:
a. American Valve.
b. FMC Crosby Valve
c. Red-White Valve Corp
d. Watts
e. Substitutions: Section 01600 - Product Requirements

2. Construction: MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, [threaded] [and single union] [double union] ends.

B. Over 2 inches (50 mm):
1. Manufacturers:
a. American Valve
b. FMC Crosby Valve
c. Red-White Valve Corp..
d. Watts
e. Substitutions: Section 01600 - Product Requirements.

2. Construction: MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.7 RELIEF VALVES

A. Temperature and Pressure Relief:
1. Manufacturers:

a. American Valve.
b. FMC Crosby Valve
c. Red-White Valve Corp.
d. Substitutions: Section 01600 - Product Requirements

2. Construction: AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME SEC IV certified and labeled.

2.8 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe 2 inches (50 mm) and Under:
1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 inches (50 mm):
1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
2. Copper Piping: Bronze.

C. Gaskets: 1/16-inch (1.6 mm) thick preformed neoprene.

D. Grooved and Shouldered Pipe End Couplings:
1. Housing Clamps: Malleable iron [galvanized] to engage and lock designed to permit some angular deflection, contraction, and expansion.
2. Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.

E. Accessories: Steel bolts, nuts, and washers.

F. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify Piping System is ready for installation.

3.2 INSTALLATION

A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

B. Install valves with stems upright or horizontal, not inverted.

C. Use grooved mechanical couplings and fasteners only in accessible locations.

D. Install unions downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

E. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Install globe valves for throttling, bypass, or manual flow control services.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide plug valves in natural gas systems for shut-off service.

I. Use 3/4 inch (20 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Conform to applicable piping specification for hangers and insulation.

END OF SECTION 15110

SECTION 15120 PIPING - SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pressure gages.
2. Pressure gage taps.
3. Thermometers.
4. Flexible connectors.

B. Related Sections:
1. Section 15140 - Domestic Water Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. American Society for Testing and Materials:
1. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
4. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
5. ASTM E1 - Standard Specification for ASTM Thermometers.
6. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

C. American Water Works Association:
1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
3. AWWA C702 - Cold-Water Meters - Compound Type.
4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. Underwriters Laboratories Inc.:
1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer’s data [and list] indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.7 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Gage: ASME B40.1, UL 393, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
1. Case: Stainless steel.
2. Bourdon Tube: Brass
3. Dial Size: 4 inch diameter.
4. Mid-Scale Accuracy: two percent.
5. Scale: Psi.

2.2 PRESSURE GAGE TAPS

A. Ball Valve: Brass Stainless Steel 1/4 inch (6 mm) NPT for 250 psi (1720 kPa).

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) NPT connections.

2.3 STEM TYPE THERMOMETERS

A. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
1. Size: 7-inch scale.
2. Window: Clear Lexan.
3. Stem: Brass, 3/4 inch (20 mm) NPT long.
4. Accuracy: [ASTM E77] 2 percent.
5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions

2.5 FLEXIBLE CONNECTORS

A. Manufacturers:

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure 300 psig

2.6 STRAINERS

A. Size 2 inch (50 mm) and Smaller:
1. Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

B. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
1. Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

PART 3 EXECUTION

3.1 INSTALLATION - METERS

A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet.

3.2 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install gage taps in piping

C. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (65 mm) for installation of thermometer sockets. Allow clearance from insulation.

E. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Requirements for protecting installed construction.

3.4 SCHEDULES

A. Pressure Gages.
   1. Standpipe and sprinkler water supply connection.
      a. Location: Standpipe Room
      b. Scale range: 0-250 Psi
   2. Pressure reducing valves.
      a. Location: Water room
      b. Scale range: 0-150 psi
   3. Back-flow preventing device.
      a. Location: Water Room
      b. Scale range: 0-150 psi

B. Pressure Gage Tapping Location:
   1. Control valves 3/4 inch (20 mm) & larger - inlets and outlets.

C. Stem Type Thermometers:
   1. Domestic hot water supply and circulating lines.
      a. Location: Mechanical Rooms
      b. Scale range: 0-250 degrees F

D. Thermometer Socket Location:
   1. Control valves 1 inch (25 mm) & larger - inlets and outlets.

2. Reheat coils - inlets and outlets.
3. Cabinet heaters - inlets and outlets.
4. Unit heaters - inlets and outlets.

END OF SECTION 15120

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes domestic water piping, valves, fittings, hangers, pumps, controls and accessories.

B. Related Sections:
1. Section 15100 – Building Services Piping: (Optional short phrase).
2. Section 03100 – Concrete Forms and Accessories: Execution requirements for placement of inserts and sleeves specified by this section.
3. Section 03300 – Cast-in-Place Concrete: Execution requirements for placement of concrete house keeping pads specified by this section.
4. Section 09900 – Paints and Coatings: Execution requirements for painting material specified by this section.
5. Section 15080 – Mechanical Identification: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 15480 – Domestic Water Heaters: In-line circulator required for water heater.
7. Section 16150 – Wiring Devices: Execution requirements for electric connections to equipment specified by this section.
8. Section 16225 - Motors: Product requirements for motors for placement by this section.

1.2 REFERENCES

A. ASME B16.18 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Pressure Fittings.

B. ASME B16.22 (American Society of Mechanical Engineers) - Wrought Copper and Bronze Solder Joint Pressure Fittings.

C. ASME B16.26 (American Society of Mechanical Engineers) - Cast Bronze Fittings for Flared Copper Tubes.

D. ASME B31.9 (American Society of Mechanical Engineers) - Building Service Piping.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM B32 - Solder Metal.

G. ASTM B42 - Seamless Copper Pipe.

H. ASTM B88 - Seamless Copper Water Tube (ASTM B88M - Seamless Copper Water Tube [Metric]).

I. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.

J. AWWA C651 (American Water Works Association) - Disinfecting Water Mains.

K. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.

L. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.

M. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.

N. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

O. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

P. UL 1479 (National Fire Protection Association) - Fire Tests of Through-Penetration Firestops.

Q. ASME A1126.1 (American Society of Mechanical Engineers) - Water Hammer Arrestors.

R. ASSE 1011 (American Society of Sanitary Engineering) - Hose Connection Vacuum Breakers.

S. ASSE 1012 (American Society of Sanitary Engineering) - Backflow Preventers with Immediate Atmospheric Vent.

T. ASSE 1019 (American Society of Sanitary Engineering) - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

U. AWWA C506 (American Water Works Association) - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

V. PDI WH-201 (Plumbing and Drainage Institute) - Water Hammer Arrestors.

W. ASHRAE 90A (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Energy Conservation in New Building.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Submit data on pipe materials; pipe fittings, valves, and accessories. Submit manufacturers catalog information. Indicate valve data and ratings.
2. Submit pump type, capacity and power requirements.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plot. Include NPSH curve when applicable.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. Copper Tubing: ASTM B42, hard drawn.
1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA, AWS A5.8, BCuP silver braze.

B. Copper Tubing: ASTM B42, annealed
1. Fittings: ASME B16.26 cast bronze.
2. Joints: Flare

C. Ductile Iron Pipe: AWWA C151.
1. Fittings: Ductile iron, standard thickness.
2. Joints: AWWA C111, rubber gasket with ¾ inch (19 mm) diameter rods.

2.2 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88 (ASTM B88M), Type L, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

B. Copper Tubing: ASTM B88(ASTM B88M), Type L hard drawn.
1. Fittings: Cast iron, coated
2. Joints: Grooved mechanical couplings.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 3 inches (80 mm) and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Pipe Size Over 1 inch (25 mm):
1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:
1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
2. Sealing gasket: "C" shape composition sealing- gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping: Conform to ASME B31.9, ASTM F708, MSS SP58.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Carbon steel] adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe, Sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.

E. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hooks.

F. Vertical Support: Steel riser clamp.

G. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Floor Support for Hot Pipe Sizes to 4 inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plate

2.5 STRAINERS

A. Size 2 inch (50 mm) and Under:

1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

B. Size 1-1/2 inch (40 mm) to 4 inch (100 mm):
1. 1Class 125, flanged iron body, Y pattern with 1/16-inch (1.6 mm) stainless steel perforated screen.

2.6 FIRE STOP SYSTEMS

A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.

B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

2.7 HOSE BIBS

A. Manufacturers:
1. Chicago
2. JR Smith.
3. Substitutions: Section 01600 - Product Requirements.

B. Exterior: Anti-Freeze with stainless steel box and cover, replaceable hexagonal disc, hose thread spout, hand wheel, integral vacuum breaker in conformance with ANSI/ASSE 1011.

2.8 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Josum
2. JR Smith.
3. Substitutions: Section 01600 - Product Requirements.

B. ANSI A1126.1; copper construction, bellows type sized in accordance with PDI WH-201.

C. Pre-charged suitable for operation in temperature range 34 to 250 degrees F (1 to 120 degrees C)] and maximum 150 psi (1000 kPa) working pressure.

2.9 THERMOSTATIC MIXING VALVES

A. Manufacturers:
1. Bradley Model
2. Powers.
3. Substitutions: Section 01600 - Product Requirements.

B. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

C. Capacity: 2.5 gpm at 10 psi differential.

D. Accessories:
1. Check valve on inlets.
2. Volume control shut-off valve on outlet.
3. Stem thermometer on outlet.
4. Strainer stop checks on inlets.

2.10 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. TACO.
2. Grundfos
3. Substitutions: Section 01600 - Product Requirements

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B. Casing: Bronze rated for 125 psig (860 kPa) working pressure with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two, oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Flexible drive coupling.

G. Performance:
1. See schedule on drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavate

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION

A. Install Work in accordance with IPC 2003.

B. Install non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15125.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15060.

H. Provide access where valves and fittings are not exposed. [Coordinate size and location of access doors with Section 08310.]

I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

J. Excavate and backfill in accordance with Section 02324

K. Install valves with stems upright or horizontal, not inverted.

L. Install water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors.

N. Inserts:
1. Provide inserts for placement in concrete forms.
2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

O. Install potable water protection devices on plumbing lines where contamination of domestic water may occur, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

P. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

Q. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories sinks.

R. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches (100 mm) and over.
3. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.4 SERVICE CONNECTIONS

A. Provide new water service complete with approved double check back-flow preventer pressure reducing valve.

B. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide spring loaded check valves on discharge of water pumps.

3.6 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.7 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Disinfecting of Domestic Water

C. Prior to starting work, verify system is complete, flushed and clean.

D. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

E. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

F. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

G. Maintain disinfectant in system for 24 hours.

H. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

I. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

J. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 SCHEDULES

METAL PIPE HANGER SPACING

A. Pipe size: 1/2 to 1-1/4 inches (15 to 32 mm):
   1. Maximum hanger spacing: 6.5 ft. (2 m).
   2. Hanger rod diameter: 5/8 inch (9 mm).

B. Pipe size: 1-1/2 to 2 inches (40 to 50 mm):
   1. Maximum hanger spacing: 10 ft (3 m).
   2. Hanger rod diameter: 3/8 inch (9 mm).

C. Pipe size: 2-1/2 to 3 inches(65 to 75 mm):
   1. Maximum hanger spacing: 10 ft(3 m).
   2. Hanger rod diameter: 1/2 inch (13 mm).

D. Pipe size: 4 to 6 inches (100 to 150 mm):
   1. Maximum hanger spacing: 10 ft (3 m).
   2. Hanger rod diameter: 5/8 inch (15 mm).

END OF SECTION 15140

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer piping buried within 5 feet (1500 mm) of building.
2. Sanitary sewer piping above grade.
3. Floor drains.
4. Cleanouts.

B. Related Sections:
1. Section 02060 - Aggregate: Aggregate for backfill in trenches.
2. Section 02315 - Excavation and Fill: Product and execution requirements for excavation and backfill required by this section.
3. Section 02320 - Backfill: Requirements for backfill to be placed by this section.
4. Section 02324 - Trenching: Execution requirements for trenching required by this section.
5. Section 02539 - Sanitary Sewage Systems: Product and execution requirements for sanitary waste piping beyond 5 feet (1500 mm) of building.
6. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of inserts and sleeves specified by this section.
7. Section 03300 - Cast-in-Place Concrete: Execution requirements for placement of concrete specified by this section.
8. Section 08310 - Access Doors and Panels: Product requirements for access doors for placement by this section.
9. Section 09900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
10. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
11. Section 15075 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
12. Section 15105 - Pipes and Tubes: Product and installation requirements for piping materials applying to various system types.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI B16.32 - Cast Copper Alloy Solder Joint Fittings for Sovent Drainage Systems.

B. American Society of Mechanical Engineers:
1. ASME A112.21.1 - Floor Drains.
2. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
3. ASME B16.3 - Malleable Iron Threaded Fittings.
4. ASME B16.4 - Gray Iron Threaded Fittings.
5. ASME B31.9 - Building Services Piping.

C. American Society for Testing and Materials:
1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.

2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

D. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. Plumbing and Drainage Institute:
1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

C. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
1. Fittings: Cast iron.
2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.3 FLOOR DRAINS

A. Manufacturers:
1. Mifab.

2. JR Smith
3. Zurn.
4. Substitutions: Section 01600 - Product Requirements.

B. Floor Drain (FD-1): ASME A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable stainless steel or nickel-bronze strainer.

2.4 CLEANOUTS

A. Manufacturers:
1. JR Smith
2. Mifab
3. Zurn
4. Substitutions: Section 01600 - Product Requirements

B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.

C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover wit gasket.

D. Interior Finished Floor Areas: Lacquered cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.

F. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.5 BEDDING AND COVER MATERIALS

A. Reference plumbing drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.]

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, are as indicated on Drawings.

B. Verify invert elevations prior to installation of pipe.

C. Excavate pipe trench in accordance with Section 02324.

D. Place bedding material at trench bottom to provide a uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted; compact to 95 percent maximum density.

E. Install pipe on prepared bedding.

F. Route pipe in straight line.

G. [Install plastic ribbon tape continuous above pipe line; Refer to Section 15075.

H. Pipe Cover and Backfilling:
1. Backfill trench in accordance with Section 02320.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot for pipe 3” and larger and ¼” per foot for pipe less than 3” minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Provide cleanout on all vertical riser.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

G. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

H. Install piping to maintain headroom. Do not spread piping, conserve space.

I. Group piping whenever practical at common elevations.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09910.

M. Excavate and backfill in accordance with Section 02315.

N. Install bell and spigot pipe with bell end upstream.

O. Sleeve pipes passing through partitions, walls and floors.

P. Support cast iron drainage piping at every joint.

3.5 SCHEDULES

PIPE HANGER SPACING

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches (mm)	Feet (m)	Inches (mm)
1-1/4 (32)	7 (2.1)	3/8 (9)
1-1/2 (38)	9 (2.7)	3/8 (9)
2 (50)	10 (3)	3/8 (9)
2-1/2 (65)	11 (3.4)	1/2 (13)
3 (75)	12 (3.7)	1/2 (13)
4 (100)	14 (4.3)	5/8 (15)
5 (125)	16 (4.9)	5/8 (15)
6 (150)	17 (5.2)	3/4 (19)
C.I. Bell and Spigot (or No-Hub) And at Joints	5 (1.5)	5/8 (15)

END OF SECTION 15150

SECTION 15160 - STORM DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm water piping buried within 5 feet (1500 mm) of building.
2. Storm water piping above grade.
3. Roof drains.
4. Downspout nozzles.

B. Related Sections:
1. Section 02060 - Aggregate: Aggregate for backfill in trenches.
2. Section 02315 - Excavation and Fill: Product and execution requirements for excavation and backfill required by this section.
3. Section 02320 - Backfill: Requirements for backfill to be placed by this section.
4. Section 02324 - Trenching: Execution requirements for trenching required by this section.
5. Section 02630 - Storm Drainage: Product and execution requirements for storm water piping beyond 5 feet (1500 mm) of building.
6. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of inserts and sleeves specified by this section.
7. Section 03300 - Cast-in-Place Concrete: Execution requirements for placement of concrete specified by this section.
8. Section 09900 - Paints and Coatings: Execution requirements for painting material specified by this section.
9. Section 15075 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
10. Section 15105 - Pipes and Tubes: Product and installation requirements for piping materials applying to various system types.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME A112.21.1 - Floor Drains.
2. ASME A112.21.2M - Roof Drains.
3. Drainage Fittings - DWV.
4. ASME B31.9 - Building Services Piping.

B. American Society for Testing and Materials:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
4. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

C. American Water Works Association:

1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

D. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
1. Fittings: Cast iron.
2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.2 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight.
1. Fittings: Cast iron.
2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.3 ROOF DRAINS

A. Manufacturers:
1. Mifab.
2. JR Smith

3. Zurn.
4. Substitutions: Section 01600 - Product Requirements.

B. Roof Drain (RD-1):
1. Assembly: ASME A112.21.2M.
2. Body: Lacquered cast iron with sump.
3. Strainer: Removable cast metal cast iron dome.
4. Accessories: Coordinate with roofing type:
a. Membrane flange and membrane clamp with integral gravel stop.
b. Adjustable under deck clamp.
c. Roof sump receiver.
d. Waterproofing flange.
e. Controlled flow weir.
f. Levelling frame.
g. Adjustable extension sleeve for roof insulation.
h. Perforated or slotted ballast guard extension for inverted roof.
i. Perforated stainless steel ballast guard extension.

2.4 DOWNSPOUT NOZZLES

A. Manufacturers:
1. JR Smith
2. Mifab.
3. Zurn
4. Substitutions:[Section 01600 - Product Requirements.

B. Product Description: Nickel bronze body and wall flange round with straight bottom section.

2.5 BEDDING AND COVER MATERIALS

A. Reference plumbing drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom. Group piping to conserve space.

D. Group piping whenever practical at common elevations.

E. Support cast iron drainage piping at every joint.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.

G. Install piping penetrating roofed areas to maintain integrity of roof assembly.

H. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

I. Excavate and backfill in accordance with Section 02315.

J. Install bell and spigot pipe with bell end upstream.

K. Sleeve pipes passing through partitions, walls and floors. Refer to Section 15060.

3.3 SCHEDULES

PIPE HANGER SPACING

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches (mm)	Feet (m)	Inches (mm)
4 (100)	14 (4.3)	5/8 (15)
C.I. Bell and Spigot (or No-Hub) And at Joints	5 (1.5)	5/8 (15)

END OF SECTION 15160

SECTION 15190 - FUEL PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Natural gas piping buried within 5 feet (1500 mm) of building.
2. Natural gas piping above grade.
3. Flanges, unions, and couplings.
4. Pipe hangers and supports.
5. Valves.
6. Strainers.
7. Flexible connections.

B. Related Sections:
1. Section 02060 - Aggregate: Aggregate for backfill in trenches.
2. Section 02315 - Excavation and Fill: Product and execution requirements for excavation and backfill required by this section.
3. Section 02320 - Backfill: Requirements for backfill to be placed by this section.
4. Section 02324 - Trenching: Execution requirements for trenching required by this section.
5. Section 03300 - Cast-in-Place Concrete: Product requirements for concrete ballast and fill pads for underground tank for placement by this section.
6. Section 08310 - Access Doors and Panels: Product requirements for Access Doors for placement by this section.
7. Section 09900 - Paints and Coatings: Product requirements for painting for placement by this section.
8. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports and firestopping for placement by this section.
9. Section 15075 - Mechanical Identification: Product requirements for valve and pipe identification for placement by this section.
10. Section 15110 - Valves: Product requirements for valves for placement by this section.
11. Section 16150 - Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
5. ASME B31.1 - Power Piping.
6. ASME B31.4 - Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
7. ASME B31.9 - Building Services Piping.
8. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
9. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Society for Testing and Materials:
1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
5. ASTM B68M - Standard Specification for Seamless Copper Tube, Bright Annealed (Metric).
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
8. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
9. ASTM D2310 - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
10. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
11. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
12. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
7. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
8. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. NACE International:
1. NACE RP-01-69 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
2. NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.

G. National Fire Protection Association:
1. NFPA 30 - Flammable and Combustible Liquids Code.
2. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
3. NFPA 54 - National Fuel Gas Code.
4. NFPA 58 - Liquefied Petroleum Gas Code.

1.3 DEFINITIONS

A. Where the designation LPG is used, it is the abbreviation for Liquefied Petroleum Gas, most commonly Propane.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Fuel Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003 and IFC 2003

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. Steel Pipe: ASTM A53 Schedule 40 black.
1. Fittings: ASTM A234/A234M forged steel welding type.
2. Joints: ASME B31.1, ASME B31.9 welded.
3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53 Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
2. Joints: NFPA 54, threaded or welded to ASME B31.1, ASME B31.9.

B. Copper Tubing: ASTM B88, Type K ASTM B68 (ASTM B68M) or B75, General Purpose ASTM B280, ACR annealed.
1. Fittings: ASME B16.26 cast bronze.
2. Joints: Flared.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 inches (50 mm) and Smaller:
1. Ferrous pipe: 150 psi (1034 kPa) malleable iron threaded unions.
2. Copper tube: 150 psi (1034 kPa) bronze unions with brazed joints.

B. Pipe Size 2 inches (50 mm) and Larger:
1. Ferrous pipe: 150 psi (1034 kPa) forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.
2. Copper tube: 150 psi (1034 kPa) slip-on bronze flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 FLEXIBLE CONNECTORS

A. Bronze inner hose and braided exterior sleeve, suitable for minimum 200 psi (1380 kPa) CWP and 250 degrees F (121 degrees C).

PART 3 EXECUTION

3.1 EXAMINATION

A. 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.]

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Excavate and Backfill in accordance with Section 02315.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.9, ASTM F708 and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

D. Place hangers within 12 inches (300 mm) of each horizontal elbow.

E. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every [other] floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Provide copper plated hangers and supports for copper piping.

I. Prime coat exposed steel hangers and supports. [Refer to Section 09900.] Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

K. Install pipe hangers and supports in accordance with Section 15060.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Install natural gas piping in accordance with NFPA 31.

B. Install Work in accordance with IPC and IFC 2003.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install in accordance with NACE RP-01-69.

D. Route piping in orderly manner and maintain gradient.

E. Install piping to conserve building space and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15060.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08310.

K. Provide support for utility meters in accordance with requirements of utility company.

L. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

M. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09900.

N. Install identification on piping systems including underground piping. Refer to Section 15075.

O. Install valves with stems upright or horizontal, not inverted.

P. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

Q. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 7 inch wg and 2 psi. Reference plumbing detail for low pressure lines and 2 psi lines. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.5 SCHEDULES

PIPE HANGER SPACING

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches (mm)	Feet (m)	Inches (mm)
1/2 (12)	7 (2.1)	3/8 (9)
3/4 (20)	7 (2.1)	3/8 (9)

1 (25)	7 (2.1)	3/8 (9)
1-1/4 (32)	7 (2.1)	3/8 (9)
1-1/2 (38)	9 (2.7)	3/8 (9)
2 (50)	10 (3)	3/8 (9)
2-1/2 (65)	11 (3.4)	1/2 (13)
3 (75)	12 (3.7)	1/2 (13)

END OF SECTION 15190

SECTION 15410 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water closets.
2. Urinals.
3. Lavatories.
4. Sinks.
5. Service sinks.
6. Electric water coolers.

B. Related Sections:
1. Section 07900 - Joint Sealers: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 15140 - Domestic Water Piping: Supply connections to plumbing fixtures.
3. Section 15150 - Sanitary Waste and Vent Piping: Waste connections to plumbing fixtures.
4. Section 16150 - Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI Z124.1 - Plastic Bathtub Units.
3. ANSI Z124.2 - Plastic Shower Units.
4. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. Air-Conditioning and Refrigeration Institute:
1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.
3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
6. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IPC 2003.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 WATER CLOSETS

A. Manufacturers:
1. American Standard Plumbing
2. Eller
3. Kohler Co.
4. Crane
5. Substitutions: Section 01600 - Product Requirements

B. Reference drawing Plumbing Fixture Schedule for specifications

2.2 WALL HUNG URINALS

A. Manufacturers:
1. American Standard Plumbing
2. Eller
3. Kohler Co.
4. Crane
5. Substitutions: Section 01600 - Product Requirements

B. Reference drawing Plumbing Fixture Schedule for specifications

2.3 LAVATORIES

A. Manufacturers:
1. American Standard Plumbing.
2. Eller.
3. Kohler Co.
4. Crane.
5. Substitutions: Section 01600 - Product Requirements

B. Reference drawing Plumbing Fixture Schedule for specifications

C. Accessories:
1. Chrome plated 17 gage (1.3 mm) brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer or plug and strainer, (see plumbing schedule.
3. Wheel handle stops.
4. Rigid supplies.
5. Trap and waste insulated and offset to meet ADA compliance.

2.4 SINKS

A. Manufacturers:
1. American Standard Plumbing
2. Bradley Corp.
3. Eller.
4. Kohler Co.
5. Crane
6. Just
7. Substitutions: Section 01600 - Product Requirements.

B. Reference drawing Plumbing Fixture Schedule for specifications

2.5 ELECTRIC WATER COOLERS

A. Manufacturers:
1. Sunrock
2. Haws

3. Oasis.
4. Halsey Taylor
5. Substitutions: Section 01600 - Product Requirements

B. Reference drawing Plumbing Fixture Schedule for specifications

2.6 SERVICE SINKS

A. Manufacturers:
1. American Standard Plumbing
2. Bradley Corp
3. Eller.
4. Kohler Co
5. Crane
6. Substitutions: Section 01600 - Product Requirements.

B. Reference drawing Plumbing Fixture Schedule for specifications

2.7 LAVATORY INSULATION KIT

A. Manufacturers:
1. Tru Bro.
2. Substitutions: Section 01600 - Product Requirements

B. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install Work in accordance with IPC 2003

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall carriers and bolts.

F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900, color to match fixture.

G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

FIXTURE MOUNTING HEIGHTS

A. Water Closet:
   1. Standard: 15 inches to top of bowl rim.
   2. Accessible: 18 inches to top of seat.

B. Water Closet Flush Valves:
   1. Standard: 11 inches min. above bowl rim.

C. Urinal:
   1. Standard: 22 inches to top of bowl rim.
   2. Accessible: 17 inches to top of bowl rim.

D. Lavatory:
   1. Standard: 31 inches to top of basin rim.
   2. Accessible: 34 inches to top of basin rim.

E. Drinking Fountain:
   Standard Adult: 40 inches inches to top of basin rim and accessible 36 inches to top of spout.

END OF SECTION 15410

SECTION 15480 - DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Commercial gas-fired water heaters.

B. Related Sections:
1. Section 03300 - Cast-in-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
2. Section 15080 - Mechanical Insulation: Field applied insulation for domestic water heaters.
3. Section: 15140 - Domestic Water Piping: Supply connections to domestic water heaters and in-line circulator requirement..
4. Section 15190 - Fuel Piping: Execution requirements for gas and oil piping connections specified by this section.
5. Section 15450 - Potable Water Storage Tanks: Water storage tanks used with domestic water heaters.
6. Section 15550 - Breeching, Chimneys, and Stacks: Execution requirements for breeching, chimney, and stack connections to water heaters specified in this section.
7. Section 16150 - Wiring Connections: Execution requirements for electric connections specified by this section.
8. Section 16225 - Motors: Product requirements for pump motors for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
2. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.

B. American Society of Mechanical Engineers:
1. ASME PTC 25 - Pressure Relief Devices.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

C. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit certified pump curves showing pump performance characteristics with pump and system

operating point plotted. Include NPSH curve when applicable. Submit electrical characteristics and connection locations.

C. Manufacturer's Installation Instructions: Submit mounting and support requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Perform Work in accordance with IPC 2003 standard.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Products storage and handling requirements.

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect heat exchangers and tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish 10 year manufacturer warranty for domestic water heaters packaged water heating systems.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

A. Manufacturers:
1. American Water Heater Group.

2. Bradford White
3. A.O. Smith
4. Substitutions: Section 01600 - Product Requirements

B. Type: Automatic, natural gas-fired, vertical storage

C. Reference Plumbing drawing schedule for capacity

D. Tank: Glass lined coating welded steel ASME labeled; multiple flue passages, 4 inch (100 mm) diameter inspection port, thermally insulated with minimum 2 inches urethane, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

E. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

F. Approval: By AGA as automatic storage water heater operation to 180 degrees F (82 degrees C) high altitude installation.

G. Controls: Automatic water thermostat with adjustable temperature range from 120 to 180 degrees F (49 to 82 degrees C). Automatic reset high temperature limiting thermostat factory set at 195 degrees F (90 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood. 100% pilot safety, Spark ignition. Automatic reset High-Limit.

PART 3 EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches (87 mm) high and 6 inches (150 mm) larger than water heater base on each side. Refer to Section 03300.

C. Connect natural gas piping in accordance with NFPA 54.

D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

E. Connect domestic hot water, domestic cold water piping to supply and return water heater connections.

F. Install the following piping accessories. Refer to Section 15140.
1. On supply:
   a. Thermometer well and thermometer.
   b. Pressure gage.
   c. Shutoff valve.
2. On return:
   a. Thermometer well and thermometer.
   b. Shutoff valve.

G. Install the following piping accessories on natural gas piping connections. Refer to Section 15190.
1. Strainer.

2. Pressure gage.
3. Shutoff valve.
4. Pressure reducing valve.

H. Install discharge piping from relief valves and drain valves to nearest floor drain.

I. Install circulator and diaphragm expansion tank on water heater.

J. Install water heater trim and accessories furnished loose for field mounting.

K. Install electrical devices furnished loose for field mounting.

L. Install control wiring between water heater control panel and field mounted control devices.

M. Connect flue to water heater outlet, full size of outlet.

N. Install Work in accordance with IPC and IFC 2003 standards.

END OF SECTION 15480

SECTION 15550 - BREECHING, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type B double wall gas vents.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories: Execution requirements for inserts specified by this section.
2. Section 03300 - Cast-in-Place Concrete: Concrete for stack foundations.
3. Section 15060 - Hangers and Supports: Product requirements for hangers and supports for placement by this section.
4. Section 15080 - Mechanical Insulation: Execution requirements for insulation specified by this section.
5. Section 15480 - Domestic Water Heaters: Water heaters using breeching, chimneys, and stacks.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.66 - Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

B. American Society for Testing and Materials:
1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM A569/A569M - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
5. ASTM C401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories.

C. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.

D. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Guide for Steel Stack Construction.
2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
1. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances.
2. UL 127 - Factory-Built Fireplaces.
3. UL 378 - Draft Equipment.
4. UL 441 - Gas Vents.

1.3 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: Portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: Part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittals procedures.

B. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IMC and IFC 2003

B. Provide factory built vents and chimneys used for venting natural draft appliances complying with NFPA 211 and UL listed and labeled.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Maintain water integrity of roof during and after installation of chimney or vent.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 TYPE B DOUBLE WALL GAS VENTS

1. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

PART 3 EXECUTION

3.1 PREPARATION

A. Install concrete inserts for support of breeching, chimneys, and stacks in coordination with formwork.

3.2 INSTALLATION

A. Install in accordance with SMACNA Guide for Steel Stack Construction and IMC/IFC 2003.

B. For Type B double wall gas vents, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories for complete installation.

C. Install vent dampers, locating close to draft hood collar, and secured to breeching.

D. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

E. Level and plumb chimney and stacks.

F. Install slip joints allowing removal of appliances without removal or dismantling of breeching, breeching insulation, chimneys, or stacks.

END OF SECTION 15550

SECTION 15736 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Packaged rooftop air conditioning unit.
2. Roof curb.

B. Related Sections:
1. Section 15070 - Mechanical Sound, Vibration, and Seismic Control: Vibration isolators.
2. Section 15190 - Fuel Piping: Gas piping connections.
3. Section 15820 - Duct Accessories: Flexible connections.
4. Section 15940 - Sequence of Operation: Sequences of operation applying to units in this section.
5. Section 16150 - Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

C. American Society for Testing and Materials:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.
2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:
1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer’s Field Reports: Submit start-up report [for each unit].

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 210/240.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Perform Work in accordance with IMC 20032 standard.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturers warranty for compressors.

C. Furnish five year manufacturers warranty for heat exchangers.

1.10 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Maintenance service.

1.11 EXTRA MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance products.

B. Furnish one set of filters for each unit.

PART 2 PRODUCTS

2.1 ROOFTOP AIR CONDITIONING UNITS

A. Manufacturers:
1. Aaon Incorporated.
2. Carrier Corp..
3. Lennox International
4. The Trane Company
5. York International
6. Substitutions: Not Permitted

B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, gas-fired heating section, air filters, mixed air casing, controls, economizer and power exhaust as noted on drawing scheduled and accessories.

C. Configuration: Downflow air delivery

D. Roof Mounting Curb: 14 high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.

E. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, high efficiency motor. Motor permanently lubricated with built-in thermal overload protection.

F. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Galvanized drain pan with piping connection. Factory leak tested under water. Furnish coil with corrosion resistant coating capable of withstanding salt spray test of 1000 hours in accordance with ASTM B117.

G. Compressor: Hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection. Furnish internal vibration isolators, short cycle protection.

H. Refrigeration circuit: Furnish thermal expansion valve, filter-drier, suction, discharge, and liquid line service valves with gauge ports, high and low pressure safety controls.. Dehydrate and factory charge each circuit with oil and refrigerant.

I. Condenser:

1. Coil: Copper tube aluminum fin coil assembly with subcooling rows and coil guard. Factory leak tested under water. Furnish coil with corrosion resistant coating capable of withstanding salt spray test of 1000 hours in accordance with ASTM B117.
2. Condenser Fan: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high efficiency fan motors.

J. Gas-Fired Heating Section:
1. Fuel: Natural gas.
2. Heat Exchangers: Stainless steel, welded construction.
3. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot. Require unit fan operation before allowing gas valve to open.

K. Air Filters: 2 thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.

L. Mixed Air Casing:

1. Economizer: Fully modulating motorized outside air and return air dampers controlled by dry bulb controller with minimum position setting. Outside air damper normally closed and return air damper normally open. Furnish barometric relief damper capable of closing by gravity or barometric relief damper with powered exhaust. (See schedule on drawings). Furnish rain hood with screen.

M. Controls:

1. Thermostat: 7 day programmable electronic space thermostat with 2 stage heating and 2 stage cooling with automatic changeover and heating setback and cooling setup capability. Furnish system selector switch heat-off-cool and fan control switch, auto-on. Provide in tamper proof cover.

2. Status Panel: Furnish remote panel containing the following status indications:
   a. Cooling mode.
   b. Heating mode.
   c. Compressor 1.
   d. Compressor 2.
   e. Heating failure.
   f. Dirty filters.

N. Accessories:
1. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFCI type, internally mounted as indicated on drawing schedule
2. Roof Curb Adaptor Package: Furnish duct support hardware to adapt unit to existing roof curb.

O. Capacity:

1. Supply and return air: Corrected to 4220 feet altitude.
2. See schedule on drawings for capacity and electrical requirements

P. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as [shown on shop drawings] [instructed by manufacturer].

3.2 PREPARATION

A. Furnish roof curbs to for installation.

3.3 INSTALLATION

A. Roof Curb:
1. Assemble roof curb.
2. Install roof curb level.
3. Coordinate curb installation and flashing.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
5. Install gasket material between unit base and roof curb.

B. Install units on vibration isolators. Refer to Section 15070.

C. Connect units to supply and return ductwork with flexible connections. Refer to Section 15820.

D. Install condensate piping with trap and route from drain pan to splash block on roof.

E. Install components furnished loose for field mounting.

F. Install electrical devices furnished loose for field mounting.

G. Install control wiring between unit and field installed accessories.

H. Remove from roof and dispose off-site panels removed from units during installation of economizer, dampers and powered exhaust.

I. Install Work in accordance with IMC 2003.

3.4 INSTALLATION - NATURAL GAS HEATING SECTION

A. Connect natural gas piping in accordance with NFPA 54.

B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

C. Install the following piping accessories on natural gas piping connections. Refer to Section 15190.
   1. Shutoff valve.
   2. Pressure reducing valve.

D. Install natural gas piping accessories.

3.5 MANUFACTURER'S FIELD SERVICES

A. Section 01400 - Quality Requirements: Requirements for manufacturer’s field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.6 CLEANING

A. Section 01700 - Execution Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.7 DEMONSTRATION

A. Section 01700 - Execution Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner; provide at least 7 days notice to Architect/Engineer of training date.

END OF SECTION 15736

SECTION 15738 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. 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.

1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

1.6 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Lennox Industries Inc.
3. Mitsubishi Electronics America, Inc.; HVAC Division.
4. Sanyo Fisher (U.S.A.) Corp.
5. Trane Company (The); Unitary Products Group.
6. York International Corp.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

D. Fan: Direct drive, centrifugal fan.

E. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

F. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, 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.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or Scroll.
2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Fan: Aluminum-propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

F. Low Ambient Kit: Permits operation down to 0 deg F.

G. Mounting Base: Roof equipment curb.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 15 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely 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, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

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 roof-mounting compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

F. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Install refrigerant line kits per manufacturers recommendation.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections.. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

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 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures”.

END OF SECTION 15738

SECTION 15810 - DUCTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal ductwork.
2. Nonmetallic ductwork.
3. Ductwork fabrication.
4. Flexible ductwork.

B. Related Sections:
1. Section 03300 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 09900 - Paints and Coatings: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
3. Section 15060 - Hangers and Supports: Product requirements for hangers, supports and sleeves for placement by this section.

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A366/A366M - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
6. ASTM A569/A569M - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
7. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
2. SMACNA - HVAC Air Duct Leakage Test Manual.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

C. Product Data: Submit data for duct liner, duct connectors.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Manufacturers:
1. Acme Manufacturing Co..
2. Master-Fit Corp..
3. United McGill Sheet Metal.
4. Substitutions: Section 01600 - Product Requirements.

B. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

C. Steel Ducts: ASTM A366/A366M, ASTM A569/A569M, ASTM A568/A568M.

D. Fasteners: bolts, or sheet metal screws.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

A. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -10 degrees F to 160 degrees F
4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU

2.3 TRANSVERSE DUCT CONNECTION SYSTEM

A. Product Description: Rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips per SMACNA Standards.

2.4 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Furnish duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

D. Install duct hangers and supports in accordance with Section 15060.

E. Use double nuts and lock washers on threaded rod supports.

F. Connect flexible ducts to metal ducts with liquid adhesive draw bands.

G. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

3.4 CLEANING

A. Section 01700 - Execution Requirements: Final cleaning.

3.5 SCHEDULES

DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Supply	Steel
Return and Relief	Steel
General Exhaust	Steel
Combustion Air	Steel

DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Supply	2-inch wg
Return and Relief	2-inch wg
General Exhaust	2-inch wg

END OF SECTION 15810

SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Back-draft dampers.
2. Combination fire-and-smoke dampers.
3. Duct access doors.
4. Fire dampers.
5. Smoke dampers.
6. Volume control dampers.
7. Flexible duct connections
8. Duct test holes.

B. Related Sections:
1. Section 15810 - Ducts: Requirements for duct construction and pressure classifications.
2. Section 15905 - HVAC Instrumentation: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
3. Dampers for placement by this section.
4. Section 16150 - Wiring Devices: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.2 REFERENCES

A. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
1. UL 33 - Heat Responsive Links for Fire-Protection Service.
2. UL 555 - Fire Dampers.
3. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop-fabricated assemblies including volume control dampers, duct access doors.

C. Product Data: Submit data for shop fabricated assemblies including fire dampers including locations and ratings, smoke dampers including locations and ratings backdraft dampers, flexible duct connections, volume control dampers, duct access doors, and] hardware used. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IMC 2003 and SMACNA

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized extruded aluminum. Blades, maximum 6 inch (150 mm) width, center pivoted, with

felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

B. Multiple-Blade Dampers: Fabricate with 16 gage (1.5 mm) galvanized steel frame and blades. Furnish oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

C. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Furnish end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

D. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of Electro thermal link, flexible stainless steel blade edge seals to produce constant sealing pressure, stainless steel springs with locking devices [to maintain positive closure for units mounted horizontally].

E. Electro Thermal Link: Fusible link melting at 165 degrees F, 120 volts, single phase, 60 Hz; UL listed and labeled.

2.3 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch (25 mm) thick insulation with sheet metal cover.
   1. Less Than 12 inches (300 mm) square, secure with sash locks.
   2. Up to 18 inches (450 mm) Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches [with outside and inside handles].
   4. Access panels with sheet metal screw fasteners are not acceptable.

2.4 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Permanently mark dampers for use in [static] [dynamic] systems.

B. Ceiling Dampers: Galvanized steel, 22 gage (0.76 mm) frame and 16 gage (1.5 mm) flap, two layers 0.125 inch (3.2 mm) ceramic fiber on top side, with locking clip.

C. Horizontal Dampers: Galvanized steel, 22 gage (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for closure under airflow conditions. Configure with blades out of air stream except for [1.0-inch (250 Pa)] pressure class ducts up to 12 inches (300 mm) in height.

E. Multiple Blade Dampers: 16 gage (1.5 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.5 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 5555.

B. Dampers: UL Class 1 curtain type fire damper, normally [open] [closed] automatically operated by [pneumatic] [electric] actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.6 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and [as indicated on Drawings].

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

D. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches (750 mm) furnish regulator at both ends.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Connector: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installation are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside.

C. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

D. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

3.3 DEMONSTRATION

A. Section 01700 - Execution Requirements: Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION 15820

SECTION 15830 - FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof Exhaust Fan

B. Related Sections:
1. Section 15080 - Mechanical Insulation: Product requirements for power ventilators for placement by this section.
2. Section 15810 - Ducts: Product requirements for hangers for placement by this section.
3. Section 15820 - Duct Accessories: Product requirements for duct accessories for placement by this section.
4. Section 15905 - HVAC Instrumentation: Product requirements for control components to interface with fans.
5. Section 16150 - Wiring Connections: Execution and product requirements for connecting equipment specified by this section.
6. Section 16225 - Motors: Product requirements for motors for placement by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

D. Underwriters Laboratories Inc.:
1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on fans and accessories including fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit fan manufacturers instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

1.9 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Requirements for maintenance service.

PART 2 PRODUCTS

2.1 ROOF EXHAUST FANS

A. Manufacturers:
1. Cook
2. Bayley
3. ACME.
4. Substitutions: Section 01600 - Product Requirements

B. Product Requirements:
1. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300 , and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Construction:
1. Fan Unit: direct driven, with spun aluminum down blast spun aluminum exhaust fan; resilient mounted motor; 1/2 inch mesh, thick aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

D. Accessories:

1. Roof Curb: 18 inch high. self-flashing aluminum with continuously welded seams, built-in cant strips, one inch (25 mm) insulation and curb bottom[, interior baffle with acoustic insulation, curb bottom, and factory installed nailer strip.
2. Disconnect Switch: Factory-wired, non-fusible, in housing for thermal overload protected motor.
3. Back-draft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

E. Performance:
1. See Drawing Exhaust Fan Schedule for performance and electrical characteristics.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 PREPARATION

A. Furnish manufactured roof curbs for installation.

3.3 INSTALLATION

A. Secure roof fans with cadmium plated steel lag screws to roof curb.

B. Suspended Cabinet Fans: Install flexible connections specified in Section 15820 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one-inch (25 mm) flex between ductwork and fan while running.

C. Install backdraft dampers on inlet to roof (except kitchen grease hood exhaust fan) exhaust fans.

D. Install Work in accordance with IMC 2003 and SMACNA Standards.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01400 - Quality Requirements: Requirements for manufacturer’s field services.

3.5 CLEANING

A. Section 01700 - Execution Requirements: Requirements for cleaning.

3.6 DEMONSTRATION

A. Section 01700 - Execution Requirements: Requirements for demonstration and training.

B. Demonstrate fan operation and maintenance procedures.

3.7 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

END OF SECTION 15830

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

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 GRILLES AND REGISTERS

A. Fixed Face Return Grille:

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Carnes.
c. Krueger.
d. Nailor Industries of Texas Inc.
e. Price Industries.
f. Titus.
g. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core
5. Face Size: See schedule on Mechanical Drawings.
6. Duct Inlet: Square (see drawings for duct or sound boot requirements.
7. Face Style: Flush.

8. Mounting: Surface or T-bar see drawings.

9. Dampers: In duct if duct is required.

2.3 CEILING DIFFUSER OUTLETS

A. Perforated Diffuser:

1. Manufacturers:

   a. Air Distribution Products, Inc.
   b. Carnes.
   c. Krueger.
   d. METALAIRE, Inc.; Metal Industries Inc.
   e. Nailor Industries of Texas Inc.
   f. Price Industries.
   g. Titus.
   h. Tuttle & Bailey.

2. Material: Steel backpan and pattern controllers, with steel face.
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: See schedule on Mechanical Drawings.
5. Duct Inlet: Round.
6. Face Style: Flush.
7. Pattern Controller: Four or two louvered deflector patches see schedule on drawing.
8. Mounting: Surface or T-bar see drawings.
9. Dampers: In duct.

B. Radial Diffuser:

1. Manufacturers:

   a. Air Distribution Products, Inc.
   b. Carnes.
   c. Krueger.
   d. METALAIRE, Inc.; Metal Industries Inc.
   e. Nailor Industries of Texas Inc.
   f. Price Industries.
   g. Titus.
   h. Tuttle & Bailey.

2. Material: Steel backpan and pattern controllers, with steel face.
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: See schedule on Mechanical Drawings.
5. Duct Inlet: Round.
6. Face Style: Flush.
7. Pattern Controller: Radial discharge.
8. Mounting: Surface or T-bar see drawings.
9. Dampers: In duct.

2.4 SOURCE QUALITY CONTROL

A. 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 practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify 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, air extractors, and fire dampers.

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 15855

SECTION 15905 - HVAC INSTRUMENTATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes thermostats.

B. Related Sections:
1. Section 15940 - Sequence of Operation: Execution requirements for control operation specified by this section
2. Section 16150 – Wiring Connections: Execution requirements for electric connections specified by this section.
3. Section 16225 - Motors: Product requirements for electric motors for placement by this section.

1.2 REFERENCES

A. NEMA DC 3 (National Electrical Manufacturers Association) - Low-Voltage Room Thermostats.

B. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilation Systems.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit description and engineering data for each control system component. Include sizing as requested. Submit data for each system component and software module.

C. Manufacturer's Installation Instructions: Submit.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

C. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with IMC 2003

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept controls on site in original factory packaging Inspect for damage.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

1.10 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Maintenance service.

PART 2 PRODUCTS

2.1 ROOF TOP UNIT THERMOSTATS

A. Manufacturers:
1. Honeywell
2. Carrier
3. Johnson Controls
4. Trane.
5. Substitutions: Section 01600 - Product Requirements.

B. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts 7-day programmable
2. Service: cooling and heating.
3. Covers: Tamerproof cover with setpoint indication without thermometer.

C. Room Thermostat Accessories:
1. Insulating Bases: For thermostats located on exterior walls.
2. Adjusting Key: Matching device.

D. Outdoor Reset Thermostat:
1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
2. Scale range: -10 to 70 degrees F.

E. Duct mounted Air-stream Thermostats:
1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
2. Averaging service remote bulb element: 7.5 feet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify building systems to be controlled are ready to operate.

C. Verify air handling units and ductwork have been accepted and air filters are in place before installing sensors in air streams.

D. Verify location of thermostats and other exposed control sensors before installation.

3.2 INSTALLATION

A. Install Work in accordance with IMC 2003

B. Install thermostats, and other exposed control sensors after locations are coordinated with other Work.

C. Install thermostats, and other exposed control sensors 48 inches above floor.

D. Install outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide separable sockets for liquids and flanges for air bulb elements.

3.3 FIELD QUALITY CONTROL

A. Section [01400 - Quality Requirements: Execution Requirements: Testing, adjusting, and balancing.

B. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.4 DEMONSTRATION AND TRAINING

A. Demonstrate complete operation of systems, including sequence of operation prior to Date of Substantial Completion.

B. Demonstrate complete and operating system to Owner.

END OF SECTION 15905

SECTION 15940 - SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
1. Rooftop units
2. Exhaust fans.
3. Excess pressure controls.

B. Related Sections:

1. Section 15905 - HVAC Instrumentation: For equipment, devices, and system components to implement sequences of operation.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

1.3 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS
Not used.

PART 3 EXECUTION

3.1 ROOFTOP UNITS RTU-1 thru RTU-4

A. Programmable thermostat shall control unit. When thermostat calls for heat, the unit shall energize supply fan and unit heating system. When thermostat calls for cooling the unit shall energize the unit cooling system.

B. Safety Devices:
1. Smoke Detector: Stop fans and close economizer/outside dampers, when smoke is detected; signal alarm.

C. Economizer:
1. When supply fan is not running the economizer is closed.
2. When return duct carbon dioxide detector senses increase in carbon dioxide, the detector shall modulate the economizer to increase the outside air supplied.
3. See “Excess Pressure Control” below to maintain positive building pressure.

4. For cooling and outside air temperatures below 55 degrees F, modulate economizer to maintain supply air temperature of 55 degrees F.
5. For heating, modulate economizer to minimize outside air supplied.

3.2 EXHAUST FANS EF-1 and EF-2

A. Control fan by room light switch. Fans to run on activation of room lights.

3.3 EXCESS PRESSURE CONTROLS, RTU-1, RTU-2, RTU-3, and RTU-4

A. Maintain constant pressure differential between inside and outside by modulating power exhaust fans. The power exhaust fans are to modulate on to maintain an inside pressure of 0.05 inches of water column with respect to the outside.

END OF SECTION 15940

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Testing adjusting, and balancing of air systems.
2. Measurement of final operating condition of HVAC systems.
3. Sound measurement of equipment operating conditions.
4. Vibration measurement of equipment operating conditions.

B. Related Sections:

1. Section 15940 - Sequence of Operation: Sequences of operation for HVAC equipment.

1.2 REFERENCES

A. Associated Air Balance Council:
1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:
1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB Report forms containing information indicated in Schedules.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Furnish reports in as indicated in Specification 15010. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals

D. Submit balancing instrument calibration report

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three documented experience certified by AABC or NEBB.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.7 SEQUENCING

A. Section 01100 - Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS
Not used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:
1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Engineer or Owner.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities [at site altitude].

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. [Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.]

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure.

3.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Packaged Roof Top Heating/Cooling Units.
   2. Exhaust Fans.

B. Report Forms

   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date

   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate building pressurization

e. Nomenclature used throughout report
f. Test conditions

3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date

4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP and kW
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore

5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
   f. Center to center distance, maximum, minimum, and actual

6. Air Moving Equipment:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual
   g. Return air flow, specified and actual
   h. Outside air flow, specified and actual
   i. Total static pressure (total external), specified and actual
   j. Inlet pressure
   k. Discharge pressure
   l. Sheave Make/Size/Bore
   m. Number of Belts/Make/Size
   n. Fan RPM

7. Return Air/Outside Air Data:
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow

h. Return air temperature
i. Outside air temperature
j. Required mixed air temperature
k. Actual mixed air temperature
l. Design outside/return air ratio
m. Actual outside/return air ratio

8. Exhaust Fan Data:
a. Location
b. Manufacturer
c. Model number
d. Serial number
e. Air flow, specified and actual
f. Total static pressure (total external), specified and actual
g. Inlet pressure
h. Discharge pressure
i. Sheave Make/Size/Bore
j. Number of Belts/Make/Size
k. Fan RPM

9. Duct Traverse:
a. System zone/branch
b. Duct size
c. Area
d. Design velocity
e. Design air flow
f. Test velocity
g. Test air flow
h. Duct static pressure
i. Air temperature
j. Air correction factor

10. Duct Leak Test:
a. Description of ductwork under test
b. Duct design operating pressure
c. Duct design test static pressure
d. Duct capacity, air flow
e. Maximum allowable leakage duct capacity times leak factor
f. Test apparatus
1) Blower
2) Orifice, tube size
3) Orifice size
4) Calibrated
g. Test static pressure
h. Test orifice differential pressure
i. Leakage

11. Terminal Unit Data:
a. Manufacturer
b. Type, constant, variable, single, dual duct
c. Identification/number
d. Location
e. Model number

f. Size
g. Minimum static pressure
h. Minimum design air flow
i. Maximum design air flow
j. Maximum actual air flow
k. Inlet static pressure

12. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

13. Sound Level Report:
    a. Location
    b. Octave bands - equipment off
    c. Octave bands - equipment on
    d. RC level - equipment on

14. Vibration Test:
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (when applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)
    b. b) Test readings:
        1) Horizontal, velocity and displacement
        2) Vertical, velocity and displacement
        3) Axial, velocity and displacement
    c. Normally acceptable readings, velocity and acceleration
    d. Unusual conditions at time of test
    e. Vibration source (when non-complying)

END OF SECTION 15950

SECTION 16715 - VOICE AND DATA COMMUNICATION CABLING

PART 1 - GENERAL

1.1 PURPOSE AND INTENT:

A. The Utah National Guard (UTNG) desires to have Telecommunication parts installed in accordance with Industry Standard TIA/568B. All projects must be coordinated and approved through the UTNG State Telecommunications Manager (Mike Hansen, pager (801) 249-3838, to ensure that industry standards are adhered to.

B. Contact Info:

Utah Army National Guard
UT-G6-C, ATTN: Mike Hansen
P.O. Box 1776
Draper, UT 84020
FAX (801) 523-4844
mike.hansen@ut.ngb.army.mil

1.2 BACKGROUND

A. Agency Need Description: The UTNG requires that the following parts be used in conjunction with TIA/568B guidelines:

1. Telecommunication standards for New JLTC Building #3 Server Room (IDF) Standard Equipment:
   a. Siemon HD5-89D-12 Patch Panels.
   b. Siemon HD6-89D-12 Patch Panels.
   c. Siemon S210MB2-300
   d. Siemon S188-300 Vertical Wire Management
   e. Siemon S110M-WM-300 Vertical Wire Management
   f. Siemon S210MB2-300
   g. Siemon S210C-4
   h. Siemon CT-C6-C6-02 Angled Jack.
   i. Siemon CT2-FP-02 Faceplate.
   j. Siemon CT MuTOA CT-MMO-02
   k. Siemon SPB-V1 24 Port Patch Panel.
   l. Siemon Cat 6 Blue 9C6R4-E3-06-RBN
   m. Siemon Cat 6 Yellow 9C6R4-E3-05-RBN
   n. Green Backboard Metal M183 B2 (VAR)
   o. Blue Backboards Metal M183 B1 (VAR)
   p. Yellow Backboards Metal M183 B5 (VAR)
   q. Full Spool boards. M187 B1 (VAR)
   r. Marconi R66P25QC Lighting Protection Panel.
   s. SECOR WIC 012 LIU can.

t. Gas Protection Fuses 104410147

2. Manholes

   a. Copper Splice Cases 3M KB6 (is the series). You will need to talk to Mike or Toby to determine what ends need to be placed on the ends of the splice case.
   b. Fiber Splice Case Coyote 80805514 (Splice tray will depend on amount of fiber).
   c. When pulling Backbone Cable the contractor will leave a 20 ft maintenance loop in every manhole. All splices will be sealed water tight. If a case is open, it will be resealed to maintain a water tight seal. All splices in the fiber cable will be fusion spliced. Splices in the copper cable will be done in a splice case and made water tight.
   d. All telecommunications work to be done on any Utah Army National Guard Facility will be coordinated and approved though Mike Hansen (pager # (801) 249-3838) or Toby Adamson (pager # (801) 241-9942).

3. Layout for telecommunication closets will be as follows:

   a. There will be 1 or more sheets of ¾ inch plywood placed on the wall of the telecommunication closet.
   b. From left to right the positioning of the metal backboards will be Green, Blue, and Yellow. Leave proper space between the blue and yellow boards to accommodate future growth.
   c. Along the bottoms of each of the backboards install full spool boards.
   d. On the Green backboard install the copper feeds for the building. The copper feeds will be terminated to lighting protection and then to the Siemon 24 port patch panel.
   e. On the Blue backboard, the Blue CAT 6, will be terminated to the Siemon HD6-89D-12 patch panels.
   f. On the Yellow backboard, the Yellow CAT 6, will be terminated to the Siemon HD6-89D-12 patch panels.
   g. There will be two blue and two yellow CAT 6 wires pulled to each workstation outlet location. Each workstation outlet location has two 2-port Siemon CT jacks (for a total of 4-ports at each workstation). One blue and one yellow cable will go to each Siemon 2-port CT jack. Each 2-port CT jack will correlate with the same number on the patch panel (ex. Jack 101 will have one blue and one yellow wire that will be in the same location on the patch panel.). Each workstation outlet location shall have two station numbers, one per each 2-port CT jack.
   h. Fiber will be terminated in an LIU can. Termination of fiber will be SC.

4. The Contractor will provide progress reports throughout the term of the Contract to the UTNG Telecommunications Manager.

5. All wire must be tested by the contractor with a cable analyzer for its appropriate rating in accordance with TIA/568B standards. The Contractor will turn-in written results of the cable analyzer testing to the UTNG Telecommunications Manager.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.4 SUMMARY

A. This Section includes the following items for wiring systems used as signal pathways for voice and high-speed data transmission:

1. Mounting elements.
2. Unshielded twisted-pair cabling.
3. Fiber-optic cabling.
4. Workstation outlets.
5. Backboards.
6. Identification products.

1.5 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. RCDD: Registered Communications Distribution Designer.

H. RMC: Rigid metallic conduit.

I. UTP: Unshielded twisted pair.

1.6 SUBMITTALS

A. Product Data: For features, ratings, and performance of each component specified.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.

b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings:

1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
3. Cabling Administration Drawings.
4. Wiring diagrams to show typical wiring schematics including the following:

a. Workstation outlets, jacks, and jack assemblies.
b. Patch cords.
c. Patch panels.
d. Fiber-optic boxes.
e. Distribution racks.
f. Terminal racks.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. 20 year system warranty documentation.

1.7 QUALITY ASSURANCE

A. Telecommunications contractor shall be a Siemon Certified Installer. Approved telecommunications contractors are:

1. Cache Valley Electric
2. Federal Communications
3. Niels Fugal
4. Americom

B. All bidders shall visit the site prior to bid, to inspect the existing cabling system, and include in their bid any additional labor and materials as required for a complete installation to match the existing system.

C. Installer Qualifications: Cabling installer must have on staff personnel certified by BICSI.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

D. Source Limitations: Obtain all products except cables through one source from a single manufacturer.

E. 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.

F. Comply with NFPA 70, "National Electrical Code."

G. The installed structured cabling system shall be certified by Siemon, and a Siemon Cabling System warranty shall be provided. Provide any additional labor and materials as needed to meet this requirement.

1.8 COORDINATION

A. The telecommunications subcontractor shall coordinate layout of all rooms with the Owner and Engineer prior to beginning any work.

B. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute to other participants.
3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

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 SYSTEM REQUIREMENTS

A. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare positions in cross-connect and patch panels to accommodate 25% percent future increase in the number of workstations shown on Drawings and in addition to those required to accommodate Item 1.7.A. 1. thru 3. above.

2.3 MOUNTING ELEMENTS

A. Backboards: 3/4-inch, interior-grade, fire-retardant-treated plywood.

B. Distribution Racks: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

1. Module Dimension: Width compatible with EIA 310 standard 19-inch panel mounting.
2. Finish: Baked-polyester powder coat.

C. Power Strips: For mounting in the rack, with 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles, two per rack, and including the following:

1. LED indicator lights for power and protection status.
2. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
3. Cord connected with 15-foot line cord.
4. Rocker-type on-off switch, illuminated when in on position.
5. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
6. Protection modes shall be line-to-neutral, line-to-ground, and neutral-to-ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

D. Floor-Mounting Rack: Steel, freestanding, modular, with vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

2.4 UNSHIELDED TWISTED-PAIR CABLING

A. Cable Manufacturers:

1. Commscope.

B. Terminal and Connector Component and Distribution Rack Manufacturers:

1. Siemon.

C. 100-Ohm UTP: Comply with UL 444.

D. Outside Plant and Service Entrance Copper Cable:

1. Category 3, outside plant rated.

E. Horizontal Copper Cable:

1. No. 23 AWG, 100 ohm, four pair.
2. Comply with TIA/EIA-568, Category 6.
3. NFPA 70, type CMP.

2.5 FIBER-OPTIC CABLING

A. Cable Manufacturer:

1. Commscope

B. Termination and Enclosure Manufacturer:

1. SECOR

C. Fiber-Optic Cable: Laser optimized, next generation, 50/125-micrometer, multimode optical fiber.

D. Outside Plant and Service Entrance Fiber Cable:

1. Commscope Non-Armored, all dielectric “ARID CORE” series.

E. Patch Cords: Factory-made, dual fiber cables in 36-inch lengths.

F. Cable Connecting Hardware:

1. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex- and duplex-Type SC couplers. Insertion loss not more than 0.7 dB.

2.6 BACKBOARDS

A. A-C, void-free plywood, 84 inches high and 3/4-inch thick, fire rated.

2.7 GROUNDING AND BONDING

A. Materials: Comply with NFPA 70, TIA/EIA-607, and UL 467.

2.8 IDENTIFICATION PRODUCTS

A. Available Manufacturers:

1. Brady Worldwide, Inc.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."

C. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

A. Comply with BICSI TCI, TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, and TIA/EIA-569-A.

3.2 EXAMINATION

A. Examine pathway elements intended for cables.

1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Where shown on the drawings, the standard workstation outlet shall have (2) phone ports and (2) data ports, except for the following locations. Provide one 4-pair UTP cable per workstation port:

B. Comply with NECA 1.

C. Wiring Method: Install cables in raceway and cable tray.

D. Cable Installation:

1. All horizontal cabling shall be ran to the server room,
2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
3. Pulling Cable: Do not exceed manufacturer's written recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable

between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

4. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install UTP cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

    a. Do not untwist more than 1/2 inch of Categories 6 cables at connector terminations.

E. Wiring within Wiring Closets and Enclosures:

1. Install plywood backboards on walls of equipment rooms and wiring closets from floor to ceiling.
2. Mount patch panels on walls.
3. Group connecting hardware for cables into separate logical fields.
4. Train conductors to terminal points with no excess.
5. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Provide double-sided vertical all floor mounted racks.
7. In the main tele/data room, provide 12” ladder racking to properly support all cables.
8. Anchor and seismically brace all racks as per manufacturer recommendations.
9. Ground each rack with a #6 AWG green ground tied to the main ground bus

F. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:

1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: 24 inches.

2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: 12 inches.

3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment Rating between 2 and 5 kVA: 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: 6 inches.

4. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches.
5. Fluorescent Fixtures: 5 inches.

G. Conduit:

1. Comply with TIA/EIA-569-A for maximum length of conduit and bends between pull points, and for pull-box sizing.
2. Use manufactured conduit sweeps and long-radius ells whenever possible.
3. In telecommunications rooms, position conduit ends adjacent to a corner on backboard (in case of a single piece of plywood) or in the corner of room (where multiple sheets of plywood are installed around perimeter walls of room). Use cable trays to route cables if conduits cannot be located in these positions. Secure conduits to backboard when entering room from overhead. Extend conduits 1 to 3 inches in finished floor.

H. Backboards: Install plywood with 84-inch dimension from floor up toward ceiling. Butt adjacent sheets tightly, and form smooth gap-free corners.

3.4 GROUNDING

A. Comply with Division 16 Section "Grounding and Bonding" and with TIA/EIA 607.

B. Grounding Points:

1. Locate grounding terminals in each equipment room, wiring closet, rack, and cabinet.
2. Telecommunications Grounding Busbars: Mount on wall of telecommunications entrance facility, equipment room, and closet, with standoff insulators.

C. Bonding Conductors:

1. Extend from telecommunications entrance facility to electrical entrance facility and connect to grounding electrode.
2. Extend from telecommunications entrance facility to grounding busbars.
3. Extend from grounding busbars to ground terminals in equipment racks and cabinets.

D. Special Requirements:

1. Bonding conductors shall be insulated copper, No. 6 AWG minimum.
2. Install only in nonmetallic conduit, unless specifically required for protection of conductor. Metallic conduit, if used, shall be RMC. For RMC that exceeds 36 inches in length, conductors shall be bonded at each end of conduit.
3. Bonding conductors shall be installed without splices unless approved by Architect because of special circumstances. Where splices are necessary, they shall be accessible and shall be located in telecommunications spaces. Splices shall be by irreversible compression connectors or by exothermic welding.

3.5 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."

1. Coordinate identification scheme with the owner.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors.

C. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

   a. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.

5. Within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. At Workstations: Label cables within outlet boxes and attach label to device plate.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cable administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

B. Category 6 UTP Cabling Tests:

1. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
4. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568.

C. Fiber-Optic Cable Tests:

1. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Link End-to-End Attenuation Tests:

a. Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
b. Attenuation test results for horizontal links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 16715

Utah National Guard
JLTC Building No. 4
Camp Williams
(Building)

Division	Section Title	Pages
DIVISION 16 - ELECTRICAL		
16050	BASIC ELECTRICAL MATERIALS AND METHODS	4
16060	GROUNDING AND BONDING	5
16072	ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS	5
16075	ELECTRICAL IDENTIFICATION	5
16120	CONDUCTORS AND CABLES	4
16130	RACEWAYS AND BOXES	7
16139	CABLE TRAYS	5
16140	WIRING DEVICES	5
16145	LIGHTING CONTROL DEVICES	5
16410	ENCLOSED SWITCHES AND CIRCUIT BREAKERS	6
16420	ENCLOSED CONTROLLERS	6
16442	PANELBOARDS	6
16491	FUSES	2
16511	INTERIOR LIGHTING	9
16521	EXTERIOR LIGHTING	7
16665	TRANSIENT VOLTAGE SURGE SUPPRESSOR (T.V.S.S.)	4
16715	VOICE AND DATA COMMUNICATION CABLING	12
16720	FIRE ALARM	8

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Common electrical installation requirements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

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 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches above finished floor level.

I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless seismic criteria require a different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.4 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 16050

SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Grounding arrangements and connections for separately derived systems.

C. Field quality-control test reports.

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 authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, as indicated and detailed on the drawings; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 20 inches above finished floor, unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less 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.

3. 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, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16072 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.

1.2 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

1.3 PROJECT CONDITIONS

A. Site Class as Defined in the IBC: Verify with Structural Engineer of Record.

B. S_s, Mapped Maximum Considered Earthquake Spectral Response at Short Periods: Verify with Structural Engineer of Record.

C. S_1, Mapped Maximum Considered Earthquake Spectral Response at 1-Second Period: Verify with Structural Engineer of Record.

D. Assigned Seismic Use Group or Building Category as Defined in the IBC: Verify with Structural Engineer of Record.

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 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.

1. Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. ERICO International Corporation.
c. Allied Support Systems; Power-Strut Unit.
d. GS Metals Corp.
e. Michigan Hanger Co., Inc.; O-Strut Div.
f. National Pipe Hanger Corp.
g. Thomas & Betts Corporation.
h. Unistrut; Tyco International, Ltd.
i. Wesanco, Inc.

2. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel 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.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers:

1) Cooper B-Line; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Construction Products.
5) MKT Fastening, LLC.

6) Powers Fasteners.

2. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

1. Manufacturers:

a. Amber/Booth Company, Inc.
b. Loos & Co., Inc.
c. Mason Industries, Inc.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, unless requirements in this Section or applicable Code are stricter.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. 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.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated by Code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

END OF SECTION 16072

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for conductors and communication and control cable.
2. Underground-line warning tape.
3. Instruction signs.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE 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. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Letter height shall be 3/16 inch.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

B. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.

C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Instruction Signs:

1. Operating Instructions: 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.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.
   d. Motor-control centers.
   e. Disconnect switches.
   f. Enclosed circuit breakers.
   g. Motor starters.
   h. Push-button stations.
   i. Contactors.
   j. Remote-controlled switches, dimmer modules, and control devices.
   k. Electrical receptacles.
   l. Light switches.
   m. Wall mounted occupancy sensors.
   n. Ceiling mounted occupancy sensors in restrooms.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches 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. 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 trenchexceeds 16 inches overall.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway or power-limited tray cable, in cable tray, unless otherwise noted on drawings.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables 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 exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

A. 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.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
2. Division 16 Section "Electrical Supports and Seismic Restraints" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
3. Division 16 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 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. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw or compression type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Spiralduct, Inc./AFC Cable Systems, Inc.
13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 METAL WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Square D.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 3R.

C. Fittings and Accessories: Include 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.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type.

F. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Wiremold Company (The).
b. Thomas & Betts Corporation.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color to be selected by the Architect.

1. Manufacturers:

a. Panduit Corp.
b. Wiremold Company.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Floor Boxes: As specified on drawings.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include

metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.7 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard color to be selected by Architect. Paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Exposed: EMT.
2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. 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.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Do not install raceways embedded in slabs.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

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.

N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-

degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

S. Set floor boxes level and flush with finished floor surface.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

SECTION 16139 - CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Continuous, rigid, welded steel or stainless steel wire mesh cable management system.

B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. References:

1. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
2. ASTM A 380 – Specification for Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
3. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
4. ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
6. ANSI/NFPA 70 (2002) – National Electrical Code (NEC)
7. IEC 61537 (2001) – Cable Tray Systems and Cable Ladder Systems for Cable Management
8. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems
9. MIL-S-901D (Navy) –Military Specification, Requirements for Shock Tests, High Impact; Shipboard Machinery, Equipment and Systems
10. MIL-STD-167-1 (Ships) – Military Standards Mechanical Vibrations of Shipboard Equipment
11. TIA 569-A (1998) – Commercial Building Standard for Telecommunications Pathways & Spaces

1.4 SUBMITTALS

A. Comply with requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including UL Classification and NEMA/CSA Certification.

C. Shop Drawings: Submit shop drawings indicating materials, finish, dimensions, accessories, layout, supports, splices, and installation details.

D. Design Calculations: Verify loading capacities for supports.

E. Coordination Drawings: Include floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements. Data presented on these drawings are as accurate as preliminary surveys and planning can determine. Field verification, of all dimensions, routing, etc., is directed.

F. Factory-certified test reports of specified products, complying with IEC 61537, NEC, and NEMA VE 1/CSA C22.2 No. 126.1.

G. Submit manufacturer's certification indicating ISO 9001 quality certified.

H. Submit training procedure for certifying cable tray installers.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Approval and Labeling: Provide cable trays and accessories specified in this Section that are approved and labeled.

1. The Terms "Classified" pertaining to cable trays (rather than "Listed") and "Labeled": As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

C. Comply with NFPA 70, *National Electrical Code, Article 392: Cable Trays*; provide UL Classification and labels.

D. Comply with IEC 61537, *Cable Tray Systems and Cable Ladder Systems for Cable Management*.

E. Comply with NEMA VE 1/CSA C22.2 No. 126.1, *Metal Cable Tray Systems*, for materials, sizes, and configurations; provide cCSAus Certificate and labels.

F. Provide documentation of ISO 9001 quality certification.

1.6 COORDINATION

A. Coordinate layout and installation of cable tray with other installations.

1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

2. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products shall not be installed. Store cable trays and accessories in original cartons and in clean dry

space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by the following:

A. Cablofil, Inc., 8319 State Route 4, Mascoutah, IL, 62258. Phone (618) 566-3230. Toll Free (800) 658-4641. Fax (618) 566-3250. www.cablofil.com.

B. B-Line
C. Chalfant Manufacturing Company
D. GS Metals Corporation
E. MP Husky Corporation
F. P-W Industries, Inc.
G. T. J. Cope, Inc.
H. The Wiremold Company
I. Thomas & Betts Corporation

2.2 MATERIALS AND FINISHES

A. Cable Tray Materials:

1. Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture. OR

2. Stainless steel wire, AISI 304L or AISI 316L, 2B, finished cold drawn wire.

B. Cable Tray Finishes:

1. Finish for Carbon Steel Wire: One of the following finishes shall be applied after welding and bending of mesh.

a. Electrodeposited Zinc Plating: ASTM B 633, Type III, SC-1.
b. Hot-Dip Galvanizing after fabrication: ASTM A 123.
c. Powder-Coated:
(1) Black powder-coated surface treatment over Electrodeposited Zinc Plating using ASA 61 black polyester coating.
(2) Custom Color Powder-Coated surface treatment over Electrodeposited Zinc Plating.

2. Finish for Stainless Steel Wire: According to ASTM B 380.

C. Cable tray shall consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Provide splices, supports, and other fittings necessary for a complete, continuously grounded system. Wire mesh cable tray shall have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers.

1. Mesh: 2 x 4 inches (50 x 100 mm).

2. Straight Section Lengths: 118 inches (3,000 mm).

3. Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray strength; and to allow tray to remain light-weight.

4. Safety Edge: Patented Safety Edge technology on side wire to protect cable insulation and installers' hands.

5. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions.

D. Cable Tray Size:

1. Depth: Cable tray depth shall be (unless otherwise shown on drawings): *[4 inches (105 mm)]*

2. Width: Cable tray width shall be (unless otherwise shown on drawings): *[12 inches (300 mm)]*

3. Length: Cable tray section length shall be 10 feet (3000mm) unless otherwise shown on drawings.

4. Fill Ratio: Cable tray may be filled to *[40%] [50%] [60%] [100%]* of total fill capacity. Size cable tray to accommodate future cabling changes or additions.

5. Load Span Criteria:

a. Install and support cable management system in accordance with one of the following:

(1) IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7,

OR

(2) NEMA VE-1 (2002), with Safety Factor of 1.5

2.3 CABLE TRAY ACCESSORIES

A. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions. Supports shall be threaded rod trapeze style hangers, center-hung ceiling hangers, wall brackets, or underfloor supports and shall include the FAS (Fast Assembly System) so that screws, bolts, and additional tools are not required for cable tray mounting; installation time is reduced; and tray path can adapt to installation obstacles without the need for additional parts. Place supports so that support span does not exceed that shown on the drawings.

B. Cable tray splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

J. Accessories: As required to protect, support, and install a cable tray system. Accessories shall consist of, but are not limited to:
   a. CVN Covers, of same material and finish as cable tray.
   b. COT Divider Strips, of same material and finish as cable tray.
   c. Dropouts or Cablexits

d. EZ BC Beam Clamps
e. SBD or CEP Box or Conduit Exit Support Plates
f. HB-2 Wall Termination Brackets
g. EZ CL Cable Tray Label Clips
h. SZ MC Seismic Bracing Kits
i. FAS Roller Cable Pulling Kit

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.
   i. Cut cable tray wires in accordance with manufacturer’s instructions.
   ii. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.

C. Certified Installers: Cable tray installers must have successfully completed Cablofil’s Certified Installer program.

D. Remove burrs and sharp edges from cable trays.

END OF SECTION 16139

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, and ground-fault circuit interrupters.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Floor service outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. RFI: Radio-frequency interference.

E. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. 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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Bryant Electric, Inc./Hubbell Subsidiary.
b. Eagle Electric Manufacturing Co., Inc.
c. Hubbell Incorporated; Wiring Device-Kellems.
d. Leviton Mfg. Company Inc.
e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Poke-Through, Floor Service Outlets and Telephone/Power Poles:

a. Wiremold Company (The).

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.

2.3 PENDANT CORD/CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.
3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.7 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, brushed stainless steel.

D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: As indicated on drawings..

2.8 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use machine printed adhesive labels, clear with black letters.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

C. 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.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140

SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Switch-box occupancy sensors.
2. Indoor occupancy sensors.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings **(To be provided prior to beginning any work)**: Show installation details for occupancy and light-level sensors.

1. Lighting plan showing location, orientation, and coverage area of each sensor.
2. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 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. Provide all devices from one manufacturer.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.3 SWITCH-BOX OCCUPANCY SENSORS

A. Manufacturers:

1. Hubbell Lighting Inc.
2. Novitas, Inc.
3. Unenco Electronics; a Hubbell Company.
4. Watt Stopper (The).
5. Leviton

B. Description: PIR type with integral power-switching contacts rated for 800 W at 120-V ac, suitable for incandescent light fixtures, flourescent light fixtures with magnetic or electronic ballasts, or 1/6-hp motors; and rated for 1000 W at 277-V ac, suitable for incandescent light fixtures, flourescent light fixtures with magnetic or electronic ballasts, or 1/3-hp motors, minimum.

1. Include ground wire.
2. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
3. Automatic Light-Level Sensor: DO NOT PROVIDE WITH AUTOMATIC LIGHTING LEVEL SENSOR.

2.4 INDOOR OCCUPANCY SENSORS

A. Manufacturers:

1. Hubbell Lighting Inc.
2. Novitas, Inc.
3. Unenco Electronics; a Hubbell Company.
4. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted though a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: DO NOT PROVIDE WITH AUTOMATIC LIGHTING LEVEL SENSOR.

C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section " Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 16 Section "Conductors and Cables."

D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 16 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section "Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. 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.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section " Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 16145

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. UL listing for series rating of installed devices.
5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures" or "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 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. Comply with NFPA 70.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Fuses for Fusible Switches: 2 of each size and type installed.

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 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit (If required by application): Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit (Where indicated on drawings): Auxiliary set of contacts arranged to open before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with mA trip sensitivity as indicated on drawings.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip (Where indicated): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 16410

SECTION 16420 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:

1. Across-the-line, magnetic controllers.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each enclosed controller.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Nameplate legends.
c. Short-circuit current rating of integrated unit.
d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

D. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

C. 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.

D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.6 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

D. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare Fuses: Furnish two spare for every size and type installed.

2. Indicating Lights: Two of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electrical Company; GE Industrial Systems.
3. Siemens/Furnas Controls.
4. Square D.

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

B. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

2.3 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.4 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard gray paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 16 Section "Electrical Supports and Seismic Restraints."

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 16 Section "Fuses."

3.4 IDENTIFICATION

A. Identify enclosed controller, components, and control wiring according to Division 16 Section "Electrical Identification."

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers according to Division 16 Section "Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 CONNECTIONS

A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.7 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, "Motor Control - Motor Starters." Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.8 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

END OF SECTION 16420

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Panelboard Schedules: For installation in panelboards.

D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section " Closeout Procedures" or "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. 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.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Protection Div.
c. Siemens Energy & Automation, Inc.
d. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main, Neutral, and Ground Lugs: Mechanical type.
2. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

D. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices

allowable, and UL series-connected short-circuit rating, or fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
3. Fused switches.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating or interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges. Coordinate settings with engineer prior to energizing equipment.

F. Install filler plates in unused spaces.

G. Stub five 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

SECTION 16491 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches.

1.2 SUBMITTALS

A. Product Data: For each fuse type indicated.

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 authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA FU 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L, time delay.

B. Motor Branch Circuits: Class RK1, time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16491

SECTION 16511 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 16 Section "Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
2. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including occupancy sensors.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power wiring.

C. Qualification Data: For agencies providing photometric data for lighting fixtures.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. 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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace

components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two year(s) from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that 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. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Lamp Current Crest Factor: 1.7 or less.
5. BF: 0.85 or higher.
6. Power Factor: 0.98 or higher.
7. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.

C. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

D. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.

4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
3. Normal Ambient Operating Temperature: 104 deg F.
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 15 percent.
4. Transient Voltage Protection: IEEE C62.41, Category A or better.

5. Lamp Current Crest Factor: 1.5 or less.
6. Power Factor: .90 or higher.
7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
8. Protection: Class P thermal cutout.
9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

2.7 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.8 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard (For Gymnasium Area): Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.9 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature as selected by owner, and average rated life 20,000 hours, unless otherwise indicated.

C. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature as selected by owner, and average rated life of 20,000 hours, unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature as selected by owner, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.

1. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.10 HID LAMPS

A. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature as selected by owner.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Support fixtures independently of grid.

1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
3. Install at least four independent support rods or wires from structure to a tab on lighting fixture. Wires or rods shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Adjust aimable lighting fixtures to provide required light intensities.

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 16511

SECTION 16521 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections include the following:

1. Division 16 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Pole: Luminaire support structure, including tower used for large area illumination.

E. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles 50 feet or less in height is 90 mph.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.

B. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Wiring Diagrams: Power[**and control**] wiring.

C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. 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.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Exterior Lighting Device Schedule where titles below are column or row headings that 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. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F.
3. Normal Ambient Operating Temperature: 104 deg F.

2.4 HID LAMPS

A. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature as selected by the owner.

2.5 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

2.6 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Round, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As indicated by manufacturer's designations.

2.7 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

3.2 POLE INSTALLATION

A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."

B. Raise and set poles using web fabric slings (not chain or cable).

3.3 GROUNDING

A. Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole, unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

END OF SECTION 16521

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SECTION 16665 - TRANSIENT VOLTAGE SURGE SUPPRESSOR (T.V.S.S.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General contract provisions
B. Basic Electrical requirements section

1.2 SUMMARY

A. This specification describes the mechanical and electrical requirements for a Transient Voltage Surge Suppressor and RFI /EMI Facility Filter with integral disconnect, herein known and shown on all drawings as TVSS. The TVSS shall be suitable for application in category C3 environments as described in ANSI/IEEE C62.41. The TVSS shall be of parallel design and provide protection; (Line to Ground, Line to Line for Delta Systems, Line to Ground, Neutral to Ground, Line to Neutral and Line to Line for Wye distribution systems).

1.3 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with:
   1. Underwriters Laboratories (UL 1449 REV 2 and UL 1283) /Canadian Standards Association (CSA)
   2. Institute of Electrical and Electronic Engineers
   3. (ANSI/IEEE C62.11, C62,41, and C62.45)
   4. International Electro -Technical Commission IEC 601,664,801/British Standard BS-6651
   5. Federal Information Processing Standards Publication 94 /Mil-Std E-220A
   6. National Electrical Manufacturer Association (NEMA) LS1 /ISO 9001
   7. National Fire Protection Association (NFPA 20, 70, 75 and 78)

1.4 SUBMITTALS

A. The contractor shall submit all related TVSS specifications, electrical and mechanical drawings, maintenance manuals, fail safe documentation as described in Section 2.8 of this specification and U.L. 1449 Revision 2 listed surge suppression ratings of all specified protection modes.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: ISO-9001 certification or TVSS manufacturer's complete quality control and documentation procedures of Firms regularly engaged in the manufacture of TVSS product for category C3 (ANSI/IEEE C62.41) and whose product

have been in satisfactory service for not less than three years.

1.6 SAFETY CODES AND TESTING STANDARDS

A. Compliance and labeling: Listed per UL1449 Revision 2 and CSA. Complimentary listed to UL1283 as an RFI\EMI filter.

B. ANSI/IEEE compliance: Comply with ANSI/IEEE (C62.1 or C62.11) and C62.45 test procedures for Category C3 established in C62.41 (1991).

C. NEMA/NEC compliance: Comply with NEMA as applicable to construction and NEC Article 280 for installation and NEC article 110.9 / 110.10 for overcurrent protection.

PART 2 - PRODUCTS

2.1 PRODUCT

A. The TVSS shall be compatible with the electrical system, voltage, current and distribution configuration.

B. The TVSS maximum continuous operating voltage (MCOV) shall be capable of sustaining 115% of the nominal RMS voltage continuously without degradation.

C. The TVSS shall use only solid state clamping components to limit the surge voltage.

D. The TVSS shall have a one-time minimum surge current capacity for wye systems of 120 KA line - ground, 120 KA line - neutral and 120 KA neutral –ground.

E. The TVSS components shall have a response time no greater than >.5 nanoseconds, for any of the individual protection modes.

F. The TVSS shall provide electrical line noise filtering of up to 60 dB from 100 kHz to 100 MHz through the use of capacitors connected line to neutral in wye and line to line in delta services. (Frequency sweeps required)

G. The unit shall be installed in a NEMA 4/4X/12 waterproof enclosure.

H. The TVSS UL 1449 surge suppression rating for any suppression mode of the specified system (s) voltage shall not exceed:

System Voltage	Phases	Suppression Rating
120/208v	3	400V

I. The TVSS shall be capable of surviving a minimum of 25 surges of 75 KA w and 3750

sequential category C3 (20Kv \ 10Ka) surges without failure per coupling mode of protection with a typical remnant voltage of 2000V, following IEEE test procedures established in C62.45.

J. The TVSS shall use LED indicators which provide indication of suppression component failure in all protection modes including N-G, as well as form C high isolation dry contacts for remote monitoring.

K. Local support shall be provided for the TVSS as required.

L. The TVSS shall be warranted for five years for repair or replacement free on site labor.

M. TVSS shall have dual resettable digital LCD surge counters.

N. TVSS shall have auxiliary Form C contacts for indicating protection failure.

2.2 OVERCURRENT PROTECTION

A. The manufacturer shall supply test data from a nationally recognized laboratory insuring that when the TVSS suppression component(s) is installed commensurate with the installation location for this project, it shall be proven to fail without protected load interruption, in a safe non-violent manner (no smoke, fire, flame, case or module distortion, emission of molten particles or other physical damage). Failure is defined and inclusive of bolted short and high impedance (ground faulted) conditions within the suppressor. If Overcurrent Protection Devices (OPD) are utilized to obtain a fail-safe condition, then a certified test from a nationally recognized testing laboratory shall be submitted to indicate that: The OPD and suppression component(s) I^2T capacity is capable of conducting the specified transient current one-time and ten-times without operation. The OPD shall be capable of clearing both high and low impedance fault conditions (in all specified suppression modes) while protecting the TVSS against violent failure as defined above. OPD(s) supplied shall be monitored and provide internal and remote indication of suppression failure / operability. KAIC ratings of commercially available OPD(s) alone or UL 1449 Revision 2 product listing shall not constitute validity without the nationally recognized laboratory test as outlined above.

2.3 APPROVED SUPPLIERS

A. All suppliers subject to compliance with requirements in this specification must provide pre-approved products only from manufacturers such as:

1. Liebert
2. Current Technology
3. L.E.A. Dynatech
4. EFI / Vortex

5. Square D SurgeLogic
6. United Power
7. Intermatic

2.4 INSTALLATION

END OF SECTION 16665

SECTION 16720 - FIRE ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire alarm systems.

B. See Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

C. Definitions:

1. FACP: Fire alarm control panel.
2. LED: Light-emitting diode.
3. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

D. System Description:

1. Hard-wired, zoned system; multiplexed signal transmission dedicated to fire alarm service only.

E. Performance Requirements:

1. Comply with NFPA 72.
2. Fire alarm signal initiation shall be by one or more of the following devices:

   a. Manual stations.
   b. Smoke detectors.
   c. Automatic sprinkler system water flow.

3. Fire alarm signal shall initiate the following actions:

   a. Alarm notification appliances shall operate continuously.
   b. Identify alarm at the FACP.
   c. Transmit an alarm signal to the remote alarm receiving station.
   d. Unlock electric door locks in designated egress paths.
   e. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
   f. Record events in the system memory.

4. Supervisory signal initiation shall be by one or more of the following devices or actions:

   a. Operation of a fire-protection system valve tamper.

5. System trouble signal initiation shall be by one or more of the following devices or actions:

a. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
b. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
c. Loss of primary power at the FACP.
d. Ground or a single break in FACP internal circuits.
e. Abnormal ac voltage at the FACP.
f. A break in standby battery circuitry.
g. Failure of battery charging.
h. Abnormal position of any switch at the FACP or annunciator.
i. Fire-pump power failure, including a dead-phase or phase-reversal condition.

6. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP. Record event.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
2. Device Address List: Coordinate with final system programming.
3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
4. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
5. Batteries: Size calculations.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

F. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.

2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.

    a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
    b. Electronic media may be provided to Architect and authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. 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.

C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. FACP and Equipment: Simplex-Grinnell.

2. Wire and Cable:

    a. Comtran Corporation.
    b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
    c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
    d. West Penn Wire/CDT; a division of Cable Design Technologies.

2.2 FACP

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class A, Style 6.
2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
3. Actuation of alarm notification appliances, annunciation, shall occur within 10 seconds after the activation of an initiating device.

D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.

E. Power Supply for Supervision Equipment: Integral to the FACP, supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP after initiating devices are restored to normal.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the circuit breaker red and identify it with "FIRE ALARM SYSTEM POWER."

I. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

1. Batteries: Sealed lead calcium.
2. Battery and Charger Capacity: Comply with NFPA 72.

2.3 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Station Reset: Key- or wrench-operated switch.

2.4 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:

   a. Sensor: LED or infrared light source with matching silicon-cell receiver.
   b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24-V dc, nominal.
3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
4. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station at ceiling below.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
7. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.

C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output: Candela rating as indicated on the drawings.
2. Strobe Leads: Factory connected to screw terminals.

2.6 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.7 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760. To be specified by fire alarm manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

B. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

C. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

D. Audible Alarm-Indicating Devices: Install not 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.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

F. Device Location-Indicating Lights: Locate in public space near the device they monitor.

G. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

3.2 WIRING INSTALLATION

A. All fire alarm wiring shall be in conduit, NO EXCEPTIONS.

B. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

C. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

D. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is permitted when installed in raceway.
3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

E. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train 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 system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

F. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

G. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.3 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters.
3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72.

    a. Detectors that are outside their marked sensitivity range shall be replaced.

5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures” or “Demonstration and Training."

END OF SECTION 16720