MULTI-STEP BIDDING PROCESS
FOR
CONTRACTORS

Request For Solicitation For Construction Services

Stage II – General Contractors Bidders List FY09

May 19, 2009

BUILDING 5080 RENOVATION CAMP WILLIAMS

UTAH NATIONAL GUARD
RIVERTON, UTAH

DFCM Project No. 07332480

AJC Architects
703 East 1700 South
Salt Lake City, Utah 84105

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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 Supplemental General Conditions dated July 15, 2008
DFCM General Conditions dated May 25, 2005
DFCM Application and Certificate 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

INVITATION TO BID

ONLY FIRMS PRE-QUALIFIED DURING STAGE I OF THE RFS ARE ALLOWED TO BID ON THIS PROJECT

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

BUILDING 5080 RENOVATION - CAMP WILLIAMS
UTAH NATIONAL GUARD – RIVERTON, UTAH
DFCM PROJECT NO: 07332480

Project Description: Renovation of existing dining hall; interior upgrade and exterior work including utility work and exterior walls; restroom addition; electrical, mechanical, plumbing, concrete included. Construction Cost Estimate: $531,000.00.

Company	Contact	Fax	Company	Contact	Fax
Arnell-West, Inc	Jason Arnell	(801) 975-9967	Hidden Peak Electric Co	Derek Lee	(801) 262-5689
Ascent Construction	Brad L. Knowlton	(801) 299-0663	Hughes General Contr	Dan Pratt	(801) 295-0530
Bailey Construction Co	Tracy Bailey	(435) 245-6413	Interior Construction Specialist	Steve Bowers	(801) 568-1490
Benstog Construction Corp	Patrick Benstog	(801) 399-1335	JC Construction	John Cecala	(801) 262-7966
Big-D Construction	Ryan Carter	(801) 415-6900	Keller Construction	S. Daniel Hill	(801) 972-1063
Bradley Construction	Brad Piggott	(801) 298-6308	McCullough Engineering	Jim McCullough	(801) 466-4989
Broderick & Henderson	Gary Broderick	(801) 225-4697	Menlove Construction	Mike Menlove	(801) 282-6887
Bud Mahas Construction	Steve Mahas	(801) 531-0314	MW Construction Inc	Bill Shuldverg	(435) 245-4660
CECI	Brian E. Bagnell	(801) 484-4040	Onyx Construction	Mike Phillips	(801) 878-8922
Chad Husband Const	Richard Marshall	(801) 886-1784	Rueckert Construction Co	Ken M. Rueckert	(801) 253-1774
CSM Construction Inc	Dan Noorda	(801) 280-2813	Spindler Construction Corp	Gary R. Stevens	(435) 753-0728
Darrell Anderson Const	James Anderson	(435) 752-7606	Velocity Construction	J. Scott Wilson	(435) 586-4968
Entelen Design-Build LLC	Steven R. Burt	(801) 517-4398	Veritas Inc	Dan A. Parkinson	(801) 572-5899
Garff Construction	Phil Henricksen	(801) 972-1928	Wade Payne Const	Wade Payne	(801) 226-7772

The bid documents will be available at 4:00 PM Tuesday, May 19, 2009 in electronic format only on CDs from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801) 538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Wayne Smith**,** Project Manager, DFCM, at (801) 550-6536. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 9:00 AM on Thursday, May 21, 2009 at Building 1190 Camp Williams, Utah National Guard, 17800 South Redwood Road, Riverton, Utah. All pre-qualified prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 2:00 PM on Tuesday, June 2, 2009 to DFCM, 4110 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. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

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

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

STAGE II - MULTI-STEP BIDDING PROCESS

ONLY FIRMS PRE-QUALIFIED DURING STAGE I OF THE RFS ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

The following is an overview of the invitational bid process. More detailed information is contained throughout the document. Contractors are responsible for reading and complying with all information contained in this document.

Notification: DFCM will notify each registered pre-qualified firm (via fax or e-mail) when a project is ready for Construction Services and invite them to bid on the project.

Description of Work: A description of work or plans/specifications will be given to each contractor. If required, the plans and specifications will be available on the DFCM web page at http://dfcm.utah.gov and on CDs from DFCM, at 4110 State Office Building, Salt Lake City, Utah 84114.

Schedule: The Stage II Schedule shows critical dates including the mandatory pre-bid site meeting (if required), the question and answer period, the bid submittal deadline, the subcontractor list submittal deadline, etc. Contractors are responsible for meeting all deadlines shown on the schedule.

Mandatory Pre-Bid Site Meeting: If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project. At the mandatory meeting, contractors may have an opportunity to inspect the site, receive additional instructions and ask questions about project. The schedule contains information on the date, time, and place of the mandatory pre-bid site meeting.

Written Questions: All questions must be in writing and directed to DFCM's project manager assigned to this project. No others are to be contacted regarding this project. The schedule contains information on the deadline for submitting questions.

Addendum: All clarifications from DFCM will be in writing and issued as an addendum to the RFS. 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.

Submitting Bids: Bids must be submitted to DFCM 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document.

Pre-qualified List of Contractors: Contractors shall remain on DFCM's list of pre-qualified contractors provided: (a) they maintain a performance rating of 3.5 or greater on each project, (b) they are not suspended for failure to comply with requirements of their contract, (c) the firm has not undergone a significant reorganization involving the loss of key personnel (site superintendents, project managers, owners, etc.) to a degree such that the firm no longer meets the pre-qualification requirements outlined in Stage I, (d) the financial viability of the firm has not significantly changed, and (e) the firm is not otherwise disqualified by DFCM. Note: If a contractor fails to comply with items (a) through (e) above,

they may be removed from DFCM's list of pre-qualified contractors following an evaluation by a review committee. Contractors will be given the opportunity to address the review committee before a decision is made. Pre-qualified contractors are ONLY authorized to bid on projects within the discipline that they were originally pre-qualified under.

2. Drawings and Specifications and Interpretations

Drawings, specifications and other contract documents may be obtained as stated in the Invitation to Bid. If any firm is in doubt as to the meaning or interpretation of any part of the drawings, specifications, scope of work or contract documents, they shall submit, in writing, a request for interpretation to the authorized DFCM representative by the deadline identified in the schedule. Answers to questions and interpretations will be made via addenda issued by DFCM. Neither DFCM or the designer shall be responsible for incorrect information obtained by contractors from sources other than the official drawings/specifications and addenda issued by DFCM.

3. 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 Designer. Such written approval must occur prior to the deadline established for the last scheduled addendum to be issued. The Designer's written approval will be included as part of the addendum issued by DFCM. 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 Designer.

4. Addenda

All clarifications from DFCM will be in writing and issued as an addendum to the RFS. 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 shall result in disqualification from bidding. DFCM shall not be responsible for incorrect information obtained by contractors from sources other than official addenda issued by DFCM.

5. 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. Failure to respond may result in suspension from DFCM's list of pre-qualified contractors.

6. 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.

7. Permits

In concurrence with the requirements for permitting in the general conditions, it is the responsibility of the contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

8. Time is of the Essence

Time is of the essence in regard to all the requirements of the contract documents.

9. Bids

Before submitting a bid, each bidder 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 including those added via addenda. 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 Project Manager prior to the bidding deadline. Changes necessary to correct these issues will be made via addenda issued by DFCM.

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 published deadline for the 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 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. **A cashier's check cannot be used as a substitute for a bid bond.**

10. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", included as part of the 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 may be suspended from DFCM's list of pre-qualified contractors.

11. Contract and Bond

The Contractor's Agreement will be in the form provided in this document. The duration of the contract shall be for the time indicated by the project completion deadline shown on the schedule. The successful bidder, simultaneously with the execution of the Contractor's 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.

12. 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 DFCM 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. Alternates will be selected in prioritized order up to the construction cost estimate.

13. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

14. Withdrawal of Bids

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

15. DFCM Contractor Performance Rating

As a contractor completes each project, DFCM will evaluate project performance based on the enclosed "DFCM Contractor Performance Rating" form. The ratings issued on this project may affect the firm's "pre-qualified" status and their ability to obtain future work with DFCM.

Stage II
PROJECT SCHEDULE

PROJECT NAME: **BUILDING 5080 RENOVATION - CAMP WILLIAMS**
UTAH NATIONAL GUARD – RIVERTON, UTAH
DFCM PROJECT #: **07332480**

Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Tuesday	May 19, 2009	4:00 PM	DFCM 4110 State Office Building SLC, UT and the DFCM web site*
Mandatory Pre-bid Site Meeting	Thursday	May 21, 2009	9:00 AM	Building 1190 - Camp Williams Utah National Guard 17800 South Redwood Road Riverton, UT
Deadline for Submitting Questions	Wednesday	May 27, 2009	5:00 PM	Wayne Smith – DFCM E-mail wfsmith@utah.gov Fax (801) 538-3267
Addendum Deadline (exception for bid delays)	Thursday	May 28, 2009	2:00 PM	DFCM web site*
Prime Contractors Turn in Bid and Bid Bond	Tuesday	June 2, 2009	2:00 PM	DFCM 4110 State Office Building SLC, UT
Subcontractors List Due	Wednesday	June 3, 2009	2:00 PM	DFCM 4110 State Office Building SLC, UT Fax (801) 538-3677
Substantial Completion Date	Friday	October 30, 2009		

* **NOTE: 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 "Invitation to Bid" and in accordance with the Request for Bids for the **BUILDING 5080 RENOVATION – CAMP WILLIAMS – UTAH NATIONAL GUARD – RIVERTON, UTAH - DFCM PROJECT NO. 07332480** 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 **October 30, 2009**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$ 500.00** 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 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 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

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

INSTRUCTION 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, based on the following:

DOLLAR AMOUNTS FOR LISTING

PROJECTS UNDER $500,000: ALL FIRST-TIER SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE: ALL FIRST-TIER 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.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

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.

'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	CONTRACTOR 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)

* Bidders may list "self", but it is not required.

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

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

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 OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

4110 State Office Building, Salt Lake City, Utah 84114 - telephone 801-538-3018 – facsimile 801-538-3677 – http://dfcm.utah.gov

300/300/____/FVA/____/_____/__/_
Project No. _____

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 and Supplemental General Conditions dated July 15, 2008 ("also referred to as General Conditions") and 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 by _____. 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 Notice to Contractors, 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: _____

State of _____)
)
County of _____)

_____
Please type/print name clearly

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:

_____
David D. Williams, Jr. Date
DFCM Administrative Services Director

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
Lynn A. Hinrichs Date
Assistant Director Construction Management

APPROVED AS TO FORM:
ATTORNEY GENERAL
July 15, 2008
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

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

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:

Record 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. 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
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov

cc: Parties Noted
DFCM, Director

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

General Contractor Performance Rating Form

Project Name:		DFCM Project#	
Contractor: (ABC Construction, John Doe, 111-111-1111)	A/E: (ABC Architects, Jane Doe, 222-222-2222)	Original Contract Amount:	Final Contract Amount:
DFCM Project Manager:		Contract Date:	
Completion Date:		Date of Rating:	

Rating Guideline	QUALITY OF PRODUCT OR SERVICES	COST CONTROL	TIMELINESS OF PERFORMANCE	BUSINESS RELATIONS
5-Exceptional	Contractor has demonstrated an exceptional performance level in any of the above four categories that justifies adding a point to the score. Contractor performance clearly exceeds the performance levels described as "Very Good"			
4-Very Good	Contractor is in compliance with contract requirements and/or delivers quality product/service.	Contractor is effective in managing costs and submits current, accurate, and complete billings	Contractor is effective in meeting milestones and delivery schedule	Response to inquiries, technical/service/ administrative issues is effective
3-Satisfactory	Minor inefficiencies/errors have been identified	Contractor is usually effective in managing cost	Contractor is usually effective in meeting milestones and delivery schedules	Response to inquires technical/ service/administrative issues is somewhat effective
2-Marginal	Major problems have been encountered	Contractor is having major difficulty managing cost effectively	Contractor is having major difficulty meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is marginally effective
1-Unsatisfactory	Contractor is not in compliance and is jeopardizing achievement of contract objectives	Contractor is unable to manage costs effectively	Contractor delays are jeopardizing performance of contract objectives	Response to inquiries, technical/service/administrative issues is not effective

1. Rate Contractors quality of workmanship, management of sub contractor performance, project cleanliness, organization and safety requirement.	**Score**
Agency Comments:	
A & E Comments:	
DFCM Project Manager Comments:	

2. Rate Contractor administration of project costs, change orders and financial management of the project budget.	Score
Agency Comments:	
A & E Comments:	
DFCM Project Manager Comments:	

3. Rate Contractor's performance and adherence to Project Schedule, delay procedures and requirements of substantial completion, inspection and punch-list performance.	Score
Agency Comments:	
A & E Comments:	
DFCM Project Manager Comments:	

4. Evaluate performance of contractor management team including project manager, engineer and superintendent also include in the rating team's ability to work well with owner, user agency and consultants.	Score
Agency Comments:	
A & E Comments:	
DFCM Project Manager Comments:	

5. Rate success of Contractor's management plan, completion of the plans mitigation of project risks and performance of value engineering concepts.	Score
Agency Comments:	
A & E Comments:	
DFCM Project Manager Comments:	

Signed by:	Date:	Mean Score

Additional Comments:

project manual

Camp W. G. Williams
Riverton, Utah 84065-4999

building 5080 renovation

dfcm project #: 07332480
contract #: 087184
ajc project #: 0915

prepared for:
state of utah
department of administrative services
division of facilities and construction management
4110 state office building
salt lake city, utah 84114

prepared by:
ajc architects
703 east 1700 south
salt lake city, ut 84105
(801) 466-8818

construction documents
date: april 30, 2009

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CAMP W. G. WILLIAMS
BUILDING 5080
INTERIOR REMODEL AND RENOVATION

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SECTION 01100 - SUMMARY

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 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: DFCM Project N0. 07332480. Contract No. 087184.

Project Location:

1. Building 5080, Camp W. G. Williams, Riverton, Utah 84065-4999.
2. Owner: State of Utah.

B. Architect Identification: The Contract Documents, dated January 2008, were prepared for Project by ajc architects. 703 East 1700 South, Salt Lake City, UT 84105 Phone: 801-466-8818 Fax: 801-466-4411.

C. Project Manager: Wayne Smith, has been appointed by Owner to serve as DFCM Project Manager.

D. The Work consists of limited exterior site work associated with Selective Demolition for new exterior handicapped accessible ramps installation, utility line trenching and installation for a new grease interceptor and sampling manhole, trenching for a new fire protection system water supply line, trenching for underground power service, existing asphalt pavement patching and repairing, and new exterior doors and frames. Selective Demolition associated with interior remodel and renovation work, existing asphalt shingle replacement, including new kitchen equipment (furnished and installed by owner), replacement windows, new gypsum board assemblies, new interior doors and frames, new interior finishes including extensive floor prep and interior wall re-plastering, new interior signage, new plumbing and mechanical HVAC systems, new electrical lighting and power as required for new systems and equipment.

1. **The General Contractor is responsible to provide the flow test for the new fire sprinkler supply line installation.**

1.3 CONTRACT

A. Project will be constructed under a general construction contract.

1.4 WORK SEQUENCE

A. The Work shall be conducted in one phase as determined by a schedule provided by the General Contractor.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of exterior premises for construction operations, including use of Project site, during construction period. The camp will be in use. Coordinate with the Owner's project Manager for construction parking and staging areas. Refer to Specification Sections 01140 – WORK RESTRICTIONS and 01310 – PROJECT MANAGEMENT AND COORDINATION, for more specific information.

B. Meet all required security clearance requirements and security protocol requirements for Camp Williams. Coordinate with the DFCM and Camp Williams project managers for all requirements and submittal requirements for construction personnel back-ground checks and vehicle identification.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.7 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

Camp W. G. Williams
Building 5080
DFCM #07332480

END OF SECTION 01100

SECTION 01140 - WORK RESTRICTIONS

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 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to area of disturbance as indicated on drawings.

2. Coordinate with the Owner for scheduling work and hours of noise sensitive operations and procedures.

3. Develop detailed Demolition and Construction Schedules outlining demolition and construction activities. Coordinate with the Owner for phasing of all Demolition and Construction activities, including the start of demolition and construction activities. Coordinate with the DFCM Project Manager for scheduling to provide the least amount of disruption for continuing normal camp activities.

4. Protect all adjacent areas from noise and construction dust, dirt and debris.

5. Maintain employee access of the site as required and at all times during normal business hours.

6. Protect employees and the public from potentially dangerous or harmful construction activities at all times.

7. After hours and weekend work may be required during the course of the project. Coordinate with the Owner's security personnel for access of the camp, building and site at all times. Provide security for construction personnel as required beyond the Owner's security forces and procedures.

B. Meet all required security clearance requirements and security protocol requirements for Camp Williams. Coordinate with the DFCM and Camp Williams project managers for all requirements and submittal requirements for construction personnel back-ground checks and vehicle identification.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01140

SECTION 01220 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Sections:

1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 01 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Removal and replacement of existing damaged roof sheathing uncovered during roofing tear-off at Building 5080.

1. Description: Remove and replace damaged roof sheathing at Building 5080, in accordance with Division 06 Section "Miscellaneous Rough Carpentry", including any required panel edge blocking
2. Unit of Measurement: Per 4 foot by 8 foot sheet of plywood and any required panel blocking.

END OF SECTION 01220

SECTION 01250 - CONTRACT MODIFICATION PROCEDURES

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 specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 5 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

D. Proposal Request Form: For Change Order proposals, use forms provided by Owner. Sample copies are included at end of this Section.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

SECTION 01290 - PAYMENT PROCEDURES

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 specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

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

   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

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

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

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

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

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

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

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

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.

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

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

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

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.

6. Preinstallation conferences.
7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Designation of responsible personnel.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for processing Applications for Payment.
    g. Distribution of the Contract Documents.
    h. Submittal procedures.
    i. Preparation of Record Documents.
    j. Use of the premises.
    k. Responsibility for temporary facilities and controls.
    l. Parking availability.
    m. Office, work, and storage areas.
    n. Equipment deliveries and priorities.
    o. First aid.
    p. Security.
    q. Progress cleaning.
    r. Working hours.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.

l. Manufacturer's written recommendations.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of authorities having jurisdiction.
s. Testing and inspecting requirements.
t. Required performance results.
u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Attend progress meetings at EVERY-OTHER-WEEK intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.
14) Documentation of information for payment requests.

3. Reporting: Architect shall distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Conduct Project coordination meetings as may be required. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

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 administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Material location reports.
5. Field condition reports.
6. Special reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.4 SUBMITTALS

A. Contractor's Construction Schedule: Submit FIVE printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on 3-1/2-inch (89-mm) diskettes, formatted to hold 1.44 MB of data, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.

B. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

C. Special Reports: Submit two copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

   a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion and Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Permanent space enclosure.
    c. Completion of mechanical installation.
    d. Completion of electrical installation.
    e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, [Substantial Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 REPORTS

A. Material Location Reports: At monthly intervals, when required for pay request verification, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi- monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule during each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 01330 - SUBMITTAL PROCEDURES

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 administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.
2. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals.
5. Division 1 Section "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.

3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow 15 days for processing each resubmittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches label or beside title block to record Contractor's review and approval markings and action taken by Architect .
3. Include the following information on label for processing and recording action taken:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Unique identifier, including revision number.
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect .
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review,received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Submittal and transmittal distribution record.
i. Remarks.
j. Signature of transmitter.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. Architect, will return two copies. Mark up and retain one returned copy as a Project Record Document.
2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:

a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.
b. Final Submittal: Submit three copies, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
4. Number of Copies: Submit four blue- or black-line prints of each submittal, unless prints are required for operation and maintenance manuals. Submit five prints where prints are required for operation and maintenance manuals. Architect will retain two prints; remainder will be returned. Mark up and retain one returned print as a Project Record Drawing.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

    a. Generic description of Sample.
    b. Product name or name of manufacturer.
    c. Sample source.

4. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

    a. Size limitations.
    b. Compliance with recognized standards.
    c. Availability.
    d. Delivery time.

5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
6. Number of Samples for Verification: Submit three sets of Samples. Architect will retain one. Sample sets; remainder will be returned.

    a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

G. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

S. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01400 - QUALITY REQUIREMENTS

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 administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products 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. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of

manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work 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.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. 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 installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:

a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of 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 constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, Project Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. Obtain list of acceptable agencies from DFCM.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Project identification and temporary signs.
2. Waste disposal facilities.
3. Field offices.
4. Storage and staging areas.
5. Lifts and hoists.
6. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Pest control.
4. Security enclosure and lockup.
5. Barricades, warning signs, and lights.
6. Fire protection.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Sewer Service, where applicable: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service, where applicable: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.5 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts[, with 1-5/8-inch- (42-mm-).

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal system as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.

    a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (18.3 deg C) for finishing activities and areas where finished Work has been installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, unless overhead service must be used.
2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
3. Connect temporary service to Owner's existing power source, as directed by electric company officials.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
2. Provide warning signs at power outlets other than 110 to 120 V.
3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
4. Provide metal conduit enclosures or boxes for wiring devices.
5. Provide 4-gang outlets, spaced so 100-foot (30-m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Provide one 100-W incandescent lamp per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.
3. Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.
4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
6. Install lighting for Project identification sign.

J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

1. Cellular phones are acceptable.
2. Fax machines at Contractor home office are acceptable.

3. At each job site, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Architect's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
3. Remove snow and ice as required to minimize accumulations.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

E. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, first-aid stations, toilets, wash facilities, lunchrooms, and similar areas.

F. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. (9.2 sq. m) in area, use fire-retardant-treated material for framing and main sheathing.

F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

   a. Field Offices: Class A stored-pressure water-type extinguishers.
   b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
   c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

SECTION 01600 - PRODUCT REQUIREMENTS

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 administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 (thrity) days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

   a. Substitutions may be considered , unless otherwise indicated.

4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

   a. Substitutions may be considered, unless otherwise indicated.

5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.

8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS

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 general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. General installation of products.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

1.3 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than fourteen days in advance of proposed utility interruptions.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect.

Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect] promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

SECTION 01731 - CUTTING AND PATCHING

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 procedural requirements for cutting and patching.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

a. Processed concrete finishes.
b. Stonework and stone masonry.
c. Ornamental metal.
d. Matched-veneer woodwork.
e. Preformed metal panels.
f. Roofing.
g. Firestopping.
h. Window wall system.
i. Stucco and ornamental plaster.
j. Terrazzo.
k. Finished wood flooring.
l. Fluid-applied flooring.
m. Aggregate wall coating.
n. Wall covering.
o. Swimming pool finishes.

p. HVAC enclosures, cabinets, or covers.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete / Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

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:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.
2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 1 Section "Cutting and Patching" for cutting and patching procedures.
4. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1. Coordinate with Owner's representative, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

A. Qualification Data: For demolition firm and refrigerant recovery technician.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 1 Section "Photographic Documentation." Submit before Work begins.

E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1. Comply with submittal requirements in Division 1 Section "Construction Waste Management."

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 1 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes and or templates.

1. Comply with requirements specified in Division 1 Section "Photographic Documentation."
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Building manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of

hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Roofing: Remove no more existing roofing than required for installation of curbs and new rooftop equipment. Ensure existing building interior remains watertight and weathertight.

F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants. Refer to Mechanical plans and specifications.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 01770 - CLOSEOUT PROCEDURES

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 administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect
d. Name of Contractor.
e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble two complete sets of operation and maintenance data, and one set of electronic media in PDF format on CD-R, indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

   a. Emergency instructions and procedures.
   b. System, subsystem, and equipment descriptions, including operating standards.
   c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
   d. Description of controls and sequence of operations.
   e. Piping diagrams.

2. Maintenance Data:

   a. Manufacturer's information, including list of spare parts.
   b. Name, address, and telephone number of Installer or supplier.
   c. Maintenance procedures.
   d. Maintenance and service schedules for preventive and routine maintenance.
   e. Maintenance record forms.
   f. Sources of spare parts and maintenance materials.
   g. Copies of maintenance service agreements.
   h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner with at least seven days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.
2. Review of documentation.

3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

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 administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up Record Prints.
2. Number of Copies: Submit copies of Record Drawings as follows:

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Drawings, where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA

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 administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
5. Electronic media submittal requirements in PDF format on CD-R.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 2 copies of each corrected manual within 15 days of receipt of Architect's comments.

2. Final submittal to include 1 copy of electronic media in PDF format on CD-R.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (115-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.

3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.

4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

H. Final electronic media submittal of Operation and Maintenance in PDF format to be issued on CD-R discs as well as hard copies.

END OF SECTION 01782

SECTION 01820 - DEMONSTRATION AND TRAINING

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 administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for requirements for preinstruction conferences.
2. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual(s) for Owner's use.

B. Qualification Data: For instructors.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
1. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
2. Intrusion detection systems.
3. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping and water distribution piping.
4. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
5. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
6. HVAC instrumentation and controls.
7. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
8. Lighting equipment and controls.
9. Communication systems, including intercommunication, surveillance, clocks and programming voice and data and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:

   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:

   a. Alignments.

b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Project Manager, with at least fourteen days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01820

Camp W. G. Williams
Building 5080
DFCM #07332480

SECTION 02222

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Obtain excavation permits from state and local authorities.

B. Excavate for utility systems and process piping systems, including manholes, catch basins, valves, and other appurtenances to the points of connection with the building utility or structure piping five (5) feet outside of the building or structure.

C. Locate and protect existing utilities, structures, landscaping, and other existing features.

D. Dewater excavations as required.

E. Support excavations as required.

F. Place and compact bedding, pipe zone, and backfill materials over pipes and appurtenances to rough grade elevation.

G. Stockpile and dispose of material

1.02 QUALITY ASSURANCE

A. Provide soil testing during excavation and placement of fill and backfill materials in accordance with Section 01400.

B. Perform soil testing during excavation and placement of fill, bedding, initial backfill, and backfill materials to show compliance with the requirements of the Contract Documents.

1.03 REFERENCES

A. ASTM D422 Particle Size Analysis of Soils.

B. ASTM D424 Calculating the Plasticity Index.

C. ASTM D698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in (304.8 mm) Drop.

D. ASTM D1556 Density of Soil In Place by the Sand-Cone Method.

E. ASTM D1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10-pound rammer and 18-inch drop. (Modified Proctor).

F. ASTM D1663 Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

G. ASTM D2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

H. ASTM D2487 Classification of Soils for Engineering Purposes.

I. ASTM D2901 Test Method for Cement Content of Freshly-Mixed Soil-Cement.

J. ASTM D2922 Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).

K. ASTM D3017 Test Methods for Moisture Content.

L. ASTM D4253 Test Methods for Maximum Index Density of Soils, using a Vibratory Table.

M. ASTM D4254 Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

N. Federal Occupational Safety and Health Administration, *Federal Register*, Volume 37, No. 243, Sub-part P, Section 1926-652.

1.05 DEFINITIONS

A. Suitable Material: Excavated material from the site or imported material from off-site meeting the requirements of structural fill or non-structural fill material.

B. Unsuitable Material: Excavated material from the site that does not meet the requirements of structural fill or non-structural fill. This material shall be removed from the site.

C. Structural Fill: Fill placed on prepared subgrade in areas which will ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.

D. Non-structural Fill: Fill place on prepared subgrade outside of areas which will ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.

E. Borrow Material: Material imported from off-site but made available at an Owner owned/designated site. It is anticipated that borrow material will meet the requirements for structural fill material. If the quantity of acceptable borrow material is not sufficient to complete the Work, the Contractor shall notify the Engineer in writing. The notification shall include an estimated quantity of material required to complete the Work and the Contractor's Geotechnical Engineer's explanation for non-complying material.

1.06 SUBMITTALS

Submit the following to the Engineer:

A. Certified sieve analysis of the following materials and samples of the materials when requested by the Engineer:

1. bedding and initial backfill
2. imported trench fill
3. foundation material (if required)

B. One optimum moisture-maximum density curve for each type of soil encountered or incorporated into the Work.

C. Compaction testing results.

D. For record purposes only and not for review or approval, submit shop drawings and data showing the intended plan for dewatering operations. Include locations and capacities of dewatering wells, well points, pumps, sumps, collection, and discharge lines, standby units, water disposal methods, monitoring and settlement measuring equipment, and data collection and dissemination. Submit, together with a copy of the approved UPDES permit, as applicable, not less than 15 days prior to start of dewatering operations.

PART 2 - PRODUCTS

2.01 FOUNDATION MATERIAL

Foundation material shall be granular well-graded material with a maximum aggregate size of 2 inches and not more than 5 percent passing the 200 sieve.

2.02 BEDDING, PIPE ZONE, AND INITIAL BACKFILL MATERIAL

A. Sanitary Sewer and Storm Drain: Bedding, pipe zone, and initial backfill material shall be clean free-draining well-graded crushed gravel with a maximum aggregate size of 1inch. Crushed rock meeting the gradation requirements shown below shall be submitted for approval by the Engineer.

1-Inch Crushed Gravel

Sieve Size	Percent Passing by Weight
1"	100
3/4"	90-100
1/2"	20-55
#4	0-1
#8	0-5

B. Water, Gas, Electric, Telephone, or Buried Cables: Bedding, pipe zone, and initial backfill material shall be clean granular natural sand material, free from organic matter, conforming to the gradation requirements shown below:

3/8"	100
#4	35-100
#30	20-100

2.03 FINAL BACKFILL UNDER STRUCTURES, PAVEMENT, AND WALKS

A. Fill and final backfill for utilities under and immediately adjacent to structures, pavement prisms, and walks shall be structural fill material consisting of clean, well-graded, non-expansive granular sand and gravel material imported from off-site with a maximum size of 3 inches, no greater than 35 percent passing the No. 200 sieve, and a liquid limit of no greater than 30 percent. The material shall be capable of attaining the required densities when compacted.

B. Native material will be acceptable for final backfill under walks, pavement, or structures if it meets the requirements for structural fill material.

2.04 FINAL BACKFILL OUTSIDE OF STRUCTURES, PAVEMENT, AND WALKS

A. Fill and final backfill for utilities not under or immediately adjacent to structures, pavement prisms, and walks, shall be suitable non-structural fill material consisting of excavated material from the site, free of topsoil, debris, trash, roots, and other organic matter, frozen material, and stones larger than 3 inches in any dimension. If an adequate quantity of non-structural material is not available at the site, provide imported fill or borrow material consisting of any cohesive or granular material free from topsoil, debris, trash, roots, and other organic matter, frozen material, and stones larger than 3 inches in any dimension. The material shall not contain excessive moisture and shall readily compact and support construction equipment.

B. Whenever the native excavated material is determined by the Engineer to be unsuitable, imported acceptable material, meeting the requirements for material within rights-of-way, and capable of attaining the required densities shall be used.

2.05 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide, with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in the table below and shall bear a continuous printed inscription describing the specific utility.

Tape Color	Utility
Red	Electric
Yellow	Natural Gas, Oil, Dangerous Material
Orange	Telephone, Telegraph, Television, Police and Fire Communications
Blue	Potable Water System

Green	Industrial and Sanitary Sewer
Green & White	Compressed Air

PART 3 - EXECUTION

3.01 PROTECTION

A. Protect trees, shrubs, and lawn areas to receive planting, rock outcropping, and other features remaining as part of final landscaping.

B. Protect bench marks and existing structures, roads, sidewalks, paving, and curbs against damage from vehicular or foot traffic.

C. Protect excavations and workmen by shoring, bracing, sheet piling, underpinning, or by other methods, as required to prevent cave-ins or lose dirt from falling into excavations.

D. Shore or otherwise support adjacent structure(s) which may be damaged by excavation work. This includes service lines, pipe chases, utilities, retaining walls, etc.

E. Notify Engineer of any unexpected subsurface conditions. Discontinue work in the area until Engineer provides notification to resume work.

3.02 EXISTING UTILITIES

A. The drawings show existing utilities and their locations insofar as they are known. Utility locations and sizes may vary from those shown. Underground utilities or improvements may exist which have not been shown on the plans. All reasonable precautions shall be taken to field locate, preserve, and protect any and all such improvements.

Any improvements damaged by the Contractor which are not indicated by the drawings shall be repaired by the Contractor. Compensation for such repairs shall be covered by a Field Change Order and will be negotiated with the Engineer before corrections are made. Any such improvements damaged by the Contractor which are on the drawings shall be repaired at the expense of the Contractor.

B. Request various agencies or utility companies concerned to field-mark substructures and utilities before excavating.

C. Where it is necessary to remove, replace, or relocate such improvements in order to execute the Work, coordinate with, and obtain approval from the utility company or agency concerned.

D. If the Contractor damages any existing utility lines that are not shown, or if the locations of suspected utilities are not known to the Contractor, report immediately to the Engineer and the Owner of the utilities.

3.03 TRENCH EXCAVATING

A. Obtain required permits from local or state agencies.

B. In areas requiring reseeding or sodding, strip topsoil to a minimum depth of 12 inches, or as directed by the Engineer, and stockpile away from trench and other excavated materials for reuse.

C. Vertically cut existing pavement, sidewalk, curb and gutter, driveways, etc., along the lines forming the trench in such a manner as not to damage the adjoining pavement. Break up the portion to be removed, and remove from the site of the work immediately without causing damage to the pavement outside the limits of the trench.

D. Perform trench excavation to the alignment and grade as shown on the drawings, or as required by the Engineer.

E. As directed by the Engineer, when unsuitable foundation material is encountered at subgrade, remove unsuitable material and replace with foundation material. Contact Engineer prior to excavation of unsuitable material and placement of foundation material to gain authorization to do so.

F. Place excavated material in a manner that will not endanger the work and will cause the least possible interference with public travel.

G. Provide for uninterrupted flow of irrigation ditches, streams, wastewater, and storm drainage. Provide free access to all fire hydrants, water valves, meters, and drives.

H. Keep excavation clear of water during the progress of the Work.

I. The Contractor shall backfill, to existing grades, and barricade all trenches within roadways and parking areas at the close of each day, unless approved by the Engineer. No trenches shall be backfilled except in these areas until pipelines are properly tested.

J. The use of a trench digging machine will be permitted except in places where machines may cause damage to existing structures, in which case, hand methods shall be employed.

K. Place barriers along each excavation, at each end of excavations, along soft shoulder areas within roadways, and at other locations along the excavation as may be necessary or as required by the Engineer. Trenches shall be delineated night and day as required by applicable codes until backfilling is complete.

L. Equipment with tracks which is to be used on pavement shall be equipped with suitable pads to prevent damage to the pavement. The Contractor shall be responsible for damage done to improved surfaces. Damaged surfaces shall be repaired or replaced by and at the expense of the Contractor in a manner satisfactory to the Engineer and at no additional cost to the Owner.

M. Trenches, at the top of the initial backfill, shall be of necessary width for the proper laying of the pipe, but in no case shall the trench be less than 12 inches wider than the outside diameter of

the pipe or more than two 2 feet wider than the pipe outside diameter.

N. Trenches shall not be excavated until the pipe to be laid therein is on the site and is scheduled to be placed. The bottom of the trenches shall be accurately graded to a depth of 6 inches below the bottom of the pipe to allow for placing of granular pipe zone bedding material.

Care shall be taken not to excavate below the depths indicated. Where bell and spigot pipe is used, the minimum cover depth shall be maintained over the bell as well as under the straight portion of the pipe. Over-excavation shall be backfilled in 6-inch lifts to the proper grade with foundation or bedding material, as required by the Engineer, and shall be thoroughly consolidated and compacted as specified at no additional cost to the Owner.

O. Wasting of Material. Contractor shall remove and dispose of surplus, unsuitable and excess excavated material. Contractor shall secure waste sites for excess material. No additional payment shall be made for removal and disposal of material.

3.04 ROCK EXCAVATING

A. Rock shall be defined as follows:

1. Rock excavation shall consist of solid material and obstructions encountered with a volume in excess of 2 cubic yard. Sidewalks, pavement, and curb and gutter that cannot be excavated with a track-mounted power excavator (equivalent to Caterpillar Model No, 215C LC, rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull, and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at .81 cubic yard (heaped) capacity) without systematic drilling and blasting shall be excluded.

2. Hard and compact materials such as cemented gravels, glacial till, fractured quartzites, and relatively soft or disintegrated rock will not be considered as rock excavation. Rock excavation will not be considered as such because of intermittent drilling, blasting or ripping that is performed merely to increase production.

B. Excavation of the material claimed as rock shall not be performed until the material has been classified and cross-sectioned by the Engineer.

C. Rock payment lines are limited to the following:

Six (6) inches below invert elevation of pipe and two feet wider than inside diameter of the pipe, but not more than three (3) feet maximum trench width.

D. Excavate for and remove rock by the mechanical method.

1. Cut away rock at excavation bottom to form level bearing surface.
2. Remove shaled layers to provide sound and unshattered base for footings and foundations.
3. Remove excavated material.

4. For utility installations, cut away rock in bottom of trench to follow the proposed grade of the utility line. Eliminate sharp steps or protrusions.

E. Provide for visual inspection of bearing surfaces and cavities formed by removed rock.

F. Correct unauthorized rock removal in accordance with backfilling and compaction requirements of Section 02222.

3.05 STABILITY OF EXCAVATIONS

A. Slope sides of excavations to comply with OSHA 29 CFR Part 1926 or latest revision. Provide and install trench support systems where sloping is not possible because of space restrictions or stability of material excavated.

B. Provide proper support for all excavations to protect life, property, utilities, pavement, and the Work and to provide safe working conditions in the trench in accordance with Occupational Safety and Health Administration (OSHA) regulations, *Federal Register* Vol. 37, No. 243, Subpart P., Sec. 1926.652 or latest edition.

C. Contractor shall be responsible to determine when and where the use of trench support is employed over the use of trench boxes or sloping the sides of the excavation to the angle of repose of the material being excavated. Contractor shall be responsible for the support system used. Support systems shall be in accordance with Section 02160 - Excavation Support Systems.

D. Remove all timber and sheeting from excavations or trenching before backfilling. Cut sheeting off 2-feet below final grade if allowed by Engineer.

E. Contractor shall prevent damage to the existing improvements. Where existing improvements are damaged or affected as a result of the Contractor's work, the Contractor shall replace or repair such damage at no additional cost to the Owner.

3.06 DEWATERING

A. Provide all equipment, labor, materials, tools, and incidentals necessary to design, construct, install, and operate dewatering facilities for construction of the Work.

B. Do not discharge drainage water into storm drains unless approval by the governing agency and the Engineer is given. No discharge into sanitary sewers is allowed.

C. Water shall not be allowed to flow through the pipe lines during construction.

3.07 BACKFILLING AND COMPACTING

A. Assure that trenches are free of debris, snow, ice, and water and that ground surfaces are not in frozen condition.

B. Backfill in a systematic manner and as soon as possible after pipeline installation and leak detection testing is complete.

C. Compact materials in accordance with paragraph 3.14 Field Quality Control.

D. Foundation. When unstable earth, muck, or other foundation material is encountered in the excavation, additional excavation shall be made as directed by the Engineer, and shall be replaced with foundation materials. A minimum of 12 inches below the pipe zone will be removed and backfilled with foundation material to give a stable subgrade.

No additional payment for foundation material will be made unless the Engineer is notified of the condition and approves the use of foundation materials.

In rock excavation where over-excavation occurs the excavation shall be backfilled with foundation material to 6 inches below the pipe zone.

E. Bedding and Pipe Zone. Place bedding material to required thickness and consolidate or compact. Shovel-slice or rod the bedding in the haunch area to assure that the pipe remains true to grade, voids are eliminated beneath the pipe, and the bedding is properly compacted or consolidated.

F. Initial Backfill. Place and compact initial backfill material simultaneously on each side of the pipe for the full width of the trench in layers of 6 inches or less, to a point 12 inches over the top of the pipe and in such a manner as not to injure, damage or disturb the pipe.

G. Final Backfill.

1. Under structures, pavement prisms, walks, and where specified by the Engineer, the backfill material shall be placed in continuous horizontal layers, not exceeding 6 inches in thickness or as required by Construction Manager. Adjust moisture content of fill or backfill material, as determined by ASTM D698, as necessary to $\pm$2 percent of optimum moisture as required to obtain specified degree of compaction. Utilize borrow material as available. Provide import structural fill material as required.

2. In all areas outside of structures, pavement prisms, and walks, place non-structural fill or backfill material in continuous horizontal layers not exceeding 12 inches in thickness degree of compaction. Moisten or aerate native materials as necessary to $\pm$1 to 3 percent of optimum moisture as determined by ASTM D698.

H. In areas where the pipe is placed near the existing ground surface, mound backfill material over pipe to a depth of 4 feet of cover, or as designated on the plans. Mounding shall be accomplished with consideration for drainage problems that may develop. Mounding shall only be used where shown on the plans.

I. Distribute the backfill material in such a manner as to avoid the formation of lenses or layers of material differing substantially in characteristics from surrounding material. Do not include any roots, sod, frozen material or other perishable or unsuitable material in backfill.

J. Whenever the excavated material is not suitable for backfill, furnish or transport from other areas within the project, suitable excavated material which meets the requirements for final

backfill.

K. Remove from site and dispose of excess or undesirable excavated material not suitable or required for backfill in an appropriate acceptable manner.

L. Backfill for Appurtenances. After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for seven (7) days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be placed in such a manner as to prevent eccentric loading and excessive stress on the structure.

3.08 SPECIAL REQUIREMENTS

A. Water Lines. Trenches shall be of a depth to provide a minimum cover of 5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

B. Electrical Distribution System. Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

C. Gas Distribution. Trenches shall be excavated to the depth that will provide not less than 36 inches of cover. Trenches shall be graded as specified for pipe-laying requirements.

D. Plastic Marking Tape. Warning tapes shall be installed directly above the pipe at a depth of 18 inches below finished grade unless otherwise shown or required by the Engineer.

3.09 SOIL STORAGE (STOCKPILE) AREAS

A. Prepare areas to receive stockpile material. Clear and grub as necessary to prevent stockpiled material from contamination with unsuitable material.

B. Provide adequate drainage for stockpiles and surrounding areas by means of temporary ditches, dikes or other approved methods.

C. Stockpile suitable excavated material in an orderly manner, and at a distance from the bank of the excavation sufficient to avoid overloading or cave-ins.

D. Protect stockpiled material from contamination with unsuitable excavated material that may destroy the quality of the suitable stockpiled material. Replace stockpiled material, not adequately protected, that becomes unsuitable with suitable material at no cost to the Owner.

E. Do not place stockpile material in permanent fill material locations unless approved by the Engineer.

F. When stockpile areas are no longer needed, prior to completion of the work, grade the stockpile area to original contours and abandon/fill temporary ditches.

3.10 BORROW AREAS

A. Excavate borrow areas in such a manner as will afford adequate drainage.

B. Transport overburden and spoils material to the designated spoil area or otherwise dispose of as directed by the Engineer.

C. Operate borrow areas to minimize detrimental effects on natural environmental conditions.

D. Maintain access roads as required to permit access.

E. Slope sides of excavations or provide excavation support systems in accordance with Section 02160.

F. Trim and drain borrow areas to neat lines after the excavation is complete.

3.11 COLD WEATHER

A. Contractor shall remove and dispose of snow or ice from the construction area as necessary to perform the required work. The removal of additional deposits of snow shall not be cause for the Contractor to request an extension of contract time or additional payment.

B. The Contractor shall provide cold weather protection materials and equipment, such as heaters and blankets, as required.

C. Excavations, trenches, excavated material, and imported material shall be protected from frost or freezing, as necessary, until the excavation or trench has been backfilled.

D. The presence of frozen material or material containing frost shall not be cause for the Contractor to request an extension of contract time or additional payment.

E. The Contractor shall remove and dispose of frozen material that cannot be incorporated into the backfill.

3.12 FIELD QUALITY CONTROL

A. Densities of in-place materials shall equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D698:

COMPACTION REQUIREMENTS		
Location or Use of Fill	Percentage of Maximum Density	
Foundation, bedding, and initial trench backfill or fill material	96	
Final fill and backfill beneath structures, paved areas (including sidewalks and gravel roadways)	96	
Final fill and backfill, not beneath paved areas		

COMPACTION REQUIREMENTS		
Location or Use of Fill	Percentage of Maximum Density	
or structures	90	
Topsoil	80	
Overexcavation	95	

B. Passing overexcavation tests are required on the fills and backfills at the following frequencies:

Bedding - 1 Test per 200 L.F. of Trench
Initial Backfil - 1 Test per 200 L.F. of Trench
Final Backfill or Fill - 1 Test per 200 L.F. of Trench per lift
(outside pavement section)
Final Backfill or Fill - 1 Test per 50 L.F. of Trench per lift
(under pavement section)
Overexcavation - 1 Test per 50 L.F. of Trench per lift

C. Densities of in-place material shall be as determined by ASTM D2922.

D. Compaction tests not meeting specification requirements shall be retested, after recompaction, at Contractor's expense. The Engineer shall select the depth that the test is to be taken. The Contractor shall be responsible to dig all density testing pits at the location and depth requested. No additional payment will be made for test pits dug for compaction tests or for replacing and recompacting the backfill material.

E. Fill or backfill not compacted to the required density will be removed, recompacted, and retested at the Contractor's expense until the requirements are met. The retesting shall be at the Contractor's expense.

F. Any trenches and excavation pits improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction, rounded over, and smoothed off or pavement sections restored.

G. The Contractor shall be responsible for providing Proctor Density test results for backfill material, bedding material, and any special import backfill used. Prior to commencement of any construction the Contractor shall obtain samples of backfill material for Proctor tests. Where existing material is to be used as backfill material the Contractor shall be responsible for providing the machinery and labor to obtain soils samples of the backfill material for Proctor tests. On this project at least one sample per 1000 feet of pipe to be installed shall be required.

Additional Proctor tests may be required if backfill material changes in characteristics. Proctor tests shall be run by a Owner-approved testing laboratory. The cost of obtaining soil samples and conducting Proctor tests shall be paid by the Contractor.

No pipeline installation will begin until written results of the Proctor tests for that area have been submitted to the Engineer. The Contractor shall use the Proctor test results for testing compaction

of backfill material.

3.13 LIMITS OF CONSTRUCTION

The Contractor shall complete all work within the easement lines and rights-of-way as shown on the drawings or as directed by the Engineer. All corrections for disturbance, damage, or irregularity shall be the responsibility of the Contractor and shall hold the Owner harmless of all suits, liability and damages. All ditches, canals, and roadways shall be placed back into their original or better condition.

3.14 CLEAN UP

A. Remove all excess material, debris, sheeting, etc. from the site upon completion of the Work and dispose of properly.

B. Keep cleanup operations to within 500 feet of excavation at all times.

C. Failure to keep the cleanup operations to within 500 feet of excavation shall be sufficient cause for the Engineer to stop forward progress of excavating equipment and hold progress payments until the cleanup is up to acceptable limits and standards.

D. Any pavement, trees, shrubbery, fences, poles, or other property or structures damaged, removed, or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances or the specific direction of the Engineer or through failure to employ usual and reasonable safeguards shall be replaced or repaired at the expense of the Contractor.

END OF SECTION 02222

SECTION 02300 - EARTHWORK

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. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Drainage course for slabs-on-grade.
3. Subbase course for concrete walks and pavements.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches within building lines.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet(3 m) in width and pits more than 30 feet(9 m) in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than ten days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches(75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch(38-mm) sieve and not more than 12 percent passing a No. 200(0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch(38-mm) sieve and not more than 8 percent passing a No. 200(0.075-mm) sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch(38-mm) sieve and not more than 12 percent passing a No. 200(0.075-mm) sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch(25-mm) sieve and not more than 8 percent passing a No. 200(0.075-mm) sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch(38-mm) sieve and 0 to 5 percent passing a No. 200(0.075-mm) sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch(25-mm) sieve and 0 to 5 percent passing a No. 4(4.75-mm) sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches(150 mm) wide and 4 mils(0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches(750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches(300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches(300 mm) on each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches(150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches(150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches(150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches(450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Provide 4-inch-(100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches(750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches(100 mm) of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch(25 mm), to a height of 12 inches(300 mm) over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches(300 mm) below finished grade, except 6 inches(150 mm) below subgrade under pavements and slabs.

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches(200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches(100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches(300 mm) of existing subgrade and each layer of backfill or fill material at 98 percent.
2. Under walkways, scarify and recompact top 6 inches(150 mm) below subgrade and compact each layer of backfill or fill material at 98 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches(150 mm) below subgrade and compact each layer of backfill or fill material at 90 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch(25 mm).
2. Walks: Plus or minus 1 inch(25 mm).
3. Pavements: Plus or minus 1/2 inch(13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch(13 mm) when tested with a 10-foot(3-m) straightedge.

3.16 SUBBASE AND BASE COURSES

A. Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

B. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions and as follows:

1. Place base course material over subbase.
2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
3. Shape subbase and base to required crown elevations and cross-slope grades.
4. When thickness of compacted subbase or base course is 6 inches(150 mm) or less, place materials in a single layer.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches(300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 DRAINAGE COURSE

A. Under slabs-on-grade, install drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:

B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
2. When compacted thickness of drainage course is 6 inches(150 mm) or less, place materials in a single layer.

3. When compacted thickness of drainage course exceeds 6 inches(150 mm), place materials in equal layers, with no layer more than 6 inches(150 mm) thick or less than 3 inches(75 mm) thick when compacted.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft.(186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet(30 m) or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet(46 m) or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

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 exterior portland cement concrete paving for the following:

1. Walkways, ramps.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section "Earthwork" for subgrade preparation, grading and subbase course.
2. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Laboratory test reports for evaluation of concrete materials and mix design tests.

D. Concrete delivery tickets: A delivery ticket is required for each load of concrete and shall show the following information:

1. Number of cubic yards
2. The exact type and amount of cement, this can be indicated either by weight or volummetric quantity.
3. The amount of mixing water including free moisture in aggregates; this can be indicated either by weight or volummetric quantity.
4. If water is added at job site, (only when allowed by architect) note amount.
5. Amount of slump in inches (after addition of water, if any).
6. Type of cement.
7. Amount of air entrainment when delivered at job site.
8. Do aggregates meet ASTM specificied- yes or no. Indicate maximum size aggregate.
9. Amount and brand (or ASTM) of admixture other than air entraining agent (if any) previously approved in writing by architect.
10. Mix time.

11. Temperature on every truck load.

E. Maintain all delivery tickets on the job with a copy for the Architect. If the architect is not on the site, the superintendent or foreman shall obtain these tickets and see that they are held for him/her in a particular file so they are readily available. Note exact location of concrete placement at the project by indicating grid point identification.

F. Warranty: Submit sample of proposed warranty for approval as to form.

1.4 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. ACI 318, "Building Code Requirements for Reinforced Concrete."

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

D. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

E. Appearance Criteria: Concret exposed to view with defects which adversely affect appearance of specified finish may be repaired only by approved methods when repair work is approved by architect.

F. Strength Criteria: Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to the following:

1. Low concrete strength.
2. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.
3. Concrete which differs from required dimensions or location in such manner as to reduce strength, curing less than that specified.
4. Inadequate protection of concrt\et from extremes of temperature during early stages of hardening and strength development.
5. Mechanical injury, construction fires, accidents or premature removal of formwork lokely to result in deficient strength.
6. Workmanship likely to result in deficient strength.

G. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.

H. Core tests may be required when strength of concrete in place is considered potentially deficient.

I. If core test are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accord with Chapter 20 of ACI 318.

J. Replace concrete work judged inadequate by structural analysis or by results of load tests, if so directed by architect/engineer.

K. Contractor shall pay all costs incurred in providing additional testing and /or analysis required.

L. Tolerance Criteria:

1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to provisions of strength requirements.
2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal. If removal of excess material is permitted, accomplish in such manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or if they interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding limits of tolerances, which are exposed to view, may be rejected. Repair or remove and replace if required.
5. Finished slabs exceeding tolerances may be repaired provided strength or appearance is not adversely affected. Remove high spots with a terrazo grinder, fill low spots with patching compound, or other remedial measures performed as permitted.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. DO NOT ALLOW VEHICULAR TRAFFIC ON NEWLY PAVED AREAS UNTIL CONCRETE HAS REACHED 90% OF DESIGN CONCRETE STRENGTH.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615-82 Grade 60 (ASTM A 615M Grade 400), deformed unless otherwise indicated.

1. Epoxy coated reinforcing bars: Furnish in accordance with requirements of ASTM A 775-81 "Standard Specifications".
2. Use epoxy coated bars at exterior concrete walls, stairs beams, columns and any other locations where reinforced concrete is exposed to weather.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185-79, welded steel wire fabric. Provide fabric in flat sheets, not rolls, unless otherwise acceptable to Architect/Engineer.

D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

E. Stirrup Steel: Conform to ASTM A 82.

F. Smooth Dowel Bars for Construction Joints: ASTM A 29, Grade 60.

G. Tie Wire: Use minimum 16 gauge annealed type.

H. Fabrication: Fabrication of reinforcing bars to conform to required shapes and dimensions and in compliance with CRSI Manual and ACI 315. In the case of fabricating errors, rebended or straightening of reinforcing steel will not be permitted.

1. Locate of reinforcing splices at points of minimum stress.
2. Reinforcements with any of the following defects will not be permitted in the work:
   a. Bar lengths, depths and bends exceeding specified fabrication limits.
   b. Bends or kinks not indicated on drawings or final shop drawings.
   c. Bars with reduced cross-section due to excessive rusting or other cause.

2.3 CONCRETE MATERIALS

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

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Prohibited Admixtures: Calcium Chloride Thyocyanates or admixtures containing more than 0.1 percent chloride ions.

C. Air Entrainment: ASTM C 260, certified by manufacturer to be compatible with other required admixtures. 6-1/4 % plus or minus 1-1/4%.

D. Fly Ash (Pozzolant) : May be used in concrete not exposed to weather and may not replace cement. Use is limited to 15 percent of weight of cement with a 1.5 to 1 replacement ratio, but deducted from the aggregate weight. Loss of ignition at less than 1 percent and water requirement not to exceed 100 percent.

E. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete. Concrete mix weight should be in the range of 145 to 155 pounds per cubic foot.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

F. Lightweight Aggregates: ASTM C 330.

G. Water: Potable, clean, drinkable.

H. Synthetic Fibrous Reinforcement: Collated, fibrillated polypropylene fibers with a mix ratio of 1.5 pounds of fiber to 1.0 cubic yards of concrete.

J. Pozzolanic Admixture: ASTM C618. Use high range water reducing admixture.

K. Water-Reducing Admixture: ASTM C 494, Type A and containing not more than .I percent chloride ions.

L. High Range Water Reducing Admixture: ASTM C 494, Type F or Type G and containing not more than .1 percent chloride ions.

M. Water Reducing, Non Chloride Accelerator Admixture: ASTM C 494, Type E and containing not more than .1 percent chloride ions.

N. Integral Concrete Waterproofing Admixture: Use " Anti-Hydro or " Anti-Hydro R" integral concrete waterproofing as manufactured by Anti-Hydro company.

2.4 RELATED MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

C. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

D. Bonding Agent: Acrylic or Styrene Butadiene.

E. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

F. Curing and Sealing: Curing and sealing compound to be used on all exposed concrete flatwork and exterior surfaces of concrete beams, walls and columns. Two coat application occurring immediately after surface water dissipation and concrete finishing and at approx. 28 days from placement. Products to be used:

1. Curing: Dayton Superior Crete Cure Concentrate J-12 Crete Cure
   Approved equals must be submitted to Architect and approved in writing.
2. Sealing: L & M Construction Chemicals, Inc. Pentane

G. Expansion Joints: Shall be 1/2" thick asphalt impregnated premolded fiber complying with ASTM D 1751. Install expansion joints at intervals not to exceed 40 feet in any direction.

H. Joint sealant: Shall be a one part non-priming polyurethane sealant, gray in color. Conform to federal specification TT-S-00230c, Type II, Class A.

2.5 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability, and as approved by Engineer.

B. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

   a. 6.5 percent (moderate exposure); for 3/4 inch maximum aggregate.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.6 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

2. Limit use of fly ash (pozzolanic admixtures) to not exceed 15 percent of cement content by weight, with a 1.5 to 1 replacement ratio. Loss of ignition at less than 1 percent and water requirement not to exceed 100%.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. All conditions 4000 psi (27.6 Mpa) and 6.0 bags, 28-day compressive strength; water-cement ratio, 0.45 maximum (non-air-entrained), 0.35 maximum (air-entrained).

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches
2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.
3. Other concrete: Not more than 4 inches (100 mm).

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.7 CONCRETE MIXING

A. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. (0.76 cu. m) or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd. (0.76 cu. m), increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
3. Inserts: Form contraction joints by inserting premolded plastic, fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
3. Provide tie bars at sides of paving strips where indicated.
4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 40 feet, unless indicated otherwise.
2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.

F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

J. Cold-Weather Placement: Comply with provisions of ACI 306R 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 (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

K. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled 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 reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

B. Final Tooling: Tool edges of paving and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 1/4 inch.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 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 a 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Boiled Linseed Oil Treatment: Apply boiled linseed oil mixture no sooner than 28 days after placement to clean dry concrete surfaces free of oil, dirt, or other foreign material. Apply in 2 sprayed applications at rate of 40 sq. yd. per gallon for the first application and 60 sq. yd. per gallon for the second application. Allow complete drying between applications.

3.8 FIELD QUALITY CONTROL TESTING

A. The Owner will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

   a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
   b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
   e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

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

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 02520

Camp W. G. Williams
Building 5080
DFCM #07332480

SECTION 02575

PAVEMENT REPAIR

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section provides for the furnishing of all labor, tools, materials, equipment and in performing all operations in connection with the restoration of all existing asphalt pavement surfaces which have been removed or damaged during the course of the work under this Contract.

B. Work shall include cutting, removal, and disposal of existing pavement, and the placement of a twelve (12)-inch thick untreated base course and a bituminous surface course of a thickness equal to the adjacent existing pavement plus one (1) inch, minimum of four (4) inches total thickness.

1.02 RELATED WORK

Section 01300	Contractor Submittals
Section 01400	Quality Control
Section 02222	Excavating, Backfilling, and Compacting for Utilities
Section 02513	Asphaltic Concrete Paving

1.03 REFERENCES

A. *State of Utah Standard Specifications for Road and Bridge Construction*

B. ASTM D422 Particle Size Analysis of Soils

C. ASTM D1556 Density of Soil In Place by the Sand-Cone Method

D. ASTM D1557 Moisture Density of Soils and Soil Aggregate Mixtures using 10-pound Rammer and 18-inch Drop (Modified Proctor)

E. ASTM D1559 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

F. ASTM D2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)

G. ASTM D2950 Density of Bituminous Concrete In Place by Nuclear Methods

1.04 INSPECTION AND TESTING

A. Testing and inspection will be accomplished in accordance with Section 02513 paragraph 1.03.

1.05 SUBMITTALS (Refer to Section 02513, paragraph 1.04)

PART 2 - PRODUCTS

2.01 UNTREATED BASE COURSE

A. Untreated base course materials shall be composed of angular crushed natural stone free of shale, organic matter, and debris.

B. The gradation when tested in accordance with ASTM D422 shall be as shown on the following page.

1" GRADATION

Sieve Size	Percent Passing By Weight
1"	100
½"	79-91
#4	49-61
#16	27-35
#50	17-21
#200	7-11

2.02 ASPHALT PAVEMENT

A. Asphalt pavement shall be a mixture of local aggregates and asphalt cement plant mixed and hot laid.

B. Bituminous material to be mixed with the mineral aggregates shall be asphalt cement conforming to the *State of Utah Standard Specifications for Road and Bridge Construction*, except that minimum flash point for all grades shall be 350^0F

C. Asphalt cement shall be grade AC-10 or AC-20.

D. The percent of asphalt cement in the asphalt job mix shall be 5% to 7% by weight of total mix.

E. The combined dry mineral aggregate shall be uniformly graded and of such size that it meets one of the following gradations when tested in accordance with ASTM D422.

¾" GRADATION

Sieve Size	Percent Passing By Weight
¾"	100
½"	75-91
#4	46-62
#16	22-34
#50	11-23
#200	5-9

½" GRADATION

Sieve Size	%Passing By Weight
½"	100
#4	60-80
#16	28-42
#50	11-23
#200	5-9

F. The maximum aggregate size shall not be more than one-half the thickness of the compacted course to be constructed.

2.03 BITUMINOUS TACK COAT

A. Bituminous tack coat. Emulsified asphalt (AC-10) to be used as the tack coat shall meet the requirements of ASTM D977-80, Grade SS-1N or ASTM D2397, Grade CSS-1N.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Obtain approval from the Engineer prior to saw-cutting or removing pavement.

B. Saw-cut pavement vertically along the lines forming the trench. Do not damage pavement outside the limits of removal.

C. Remove pavement from site immediately and dispose of properly.

D. Pavement beyond the cut edge damaged during removal of the pavement or other construction operations shall be cut again to form a neat vertical edge for pavement repair at no additional cost to the Owner.

3.02 TEMPORARY PAVEMENT PLACEMENT

A. Provide temporary gravel surfaces with a minimum thickness of 6 inches in good condition immediately after final backfill is placed over pipe, and prior to opening to traffic.

B. Maintain temporary gravel surfaces in good condition by blading, sprinkling, rolling, adding gravel, etc., until final pavement is placed.

C. Complete final pavement replacement as soon as possible to provide maximum safety and convenience to traffic as directed by the Engineer or as specified in the road cut permit.

3.03 PREPARATION OF SUBGRADE

A. Ensure subgrade conforms to required grades and elevation. Remove any temporary gravel surfacing placed, to the depth of subgrade as indicated.

B. Ensure compaction of subgrade meets required density.

3.04 PLACEMENT OF UNTREATED BASE COURSE

A. Bring sub-base course to required depth(s) and profiles indicated. Extend sub-base course minimum 6 inches beyond asphalt pavement width. Place in layers not exceeding 4 inches in depth. Compact each layer to 95% maximum laboratory density, or as shown on the plans. Properly compact areas adjacent to curbs, catch basins, manholes and other areas not accessible to rollers with mechanical or hand tamping devices. Ensure granular sub-base course materials are not contaminated with deleterious materials.

B. Add water during compaction to bring granular material to optimum moisture content.

C. Spread base course materials over prepared granular sub-base to a minimum compacted depth as indicated on the drawings. Compact to 96% maximum laboratory density. Ensure top surface of base course is true to lines and grades indicated, with all points within ½ inch of elevations indicated.

D. Add water during compaction to bring stabilizing base course materials to optimum moisture content. When an excess moisture exists, rework stabilizing base course materials until optimum moisture content is obtained.

3.05 APPLICATION OF BITUMINOUS TACK COAT

A. Ensure edges of existing pavement are clean and free of loose or foreign material to permit adhesion of bituminous materials.

B. Apply tack coat material to existing pavement edges and casting immediately prior to placement of asphalt pavement.

3.06 PLACEMENT OF ASPHALT PAVEMENT

A. Obtain permits from state and local authorities before augering/jacking operations begin.

B. Place asphalt pavement to compacted depth indicated on the drawings. The maximum compacted depth of each lift of asphalt surface course shall not exceed 3-inch thickness.

C. Do not place asphalt pavement when surface temperature is 4^0C or lower; or during rainy weather; or when the subgrade, sub-base, or base course is wet or frozen; or during other unfavorable weather conditions as determined by the Engineer. Ensure asphalt pavement is minimum 118^0C immediately after placing and prior to initial rolling.

D. Compact asphalt paving surface course to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue displacement. Compact each layer to 96% maximum laboratory density, or as shown on the plans.

E. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature, minimum of 6 hours after final installation.

F. Perform hand tamping in areas not accessible to rolling equipment.

G. Ensure surface of completed asphalt pavement is true to lines, profiles, and elevations of adjacent pavement surfaces.

3.07 ADJUSTING MANHOLE FRAMES AND VALVES

A. Adjust manholes, valves, and other appurtenances to required elevations.

B. Provide asphalt collars when adjustments are required. Collars shall be placed to a minimum total pavement thickness of six (6) inches.

C. Adjustment of manholes, valves, and other appurtenances are considered incidental to the Work and no additional payment will be made for adjustments or paving repairs.

END OF SECTION 02575

Camp W. G. Williams
Building 5080
DFCM #07332480

SECTION 02710

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and specialties outside the building for the following:

1. Water services.
2. Fire-service mains.
3. Combined water service and fire-service mains.
4. Aboveground water piping for applications other than water-service piping.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Valves and accessories.
2. Water meters and accessories.
3. Backflow preventers and assemblies.
4. Fire hydrants.
5. Fire department connections.

B. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For the following:

1. Water meters.
2. Valves.
3. Backflow preventers.
4. Protective enclosures.
5. Hydrants.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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 FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.5 COORDINATION

A. Coordinate connection to water main with utility company.

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. 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 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

C. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

D. PE, ASTM Pipe: ASTM D 2239, SIDR Numbers 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 200 psig.

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.
2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

E. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

F. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.

G. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.4 JOINING MATERIALS

A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Soldering Flux: ASTM B 813, water-flushable type.

D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

2.5 VALVES

A. AWWA, Cast-Iron, Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

   a. Minimum Working Pressure: 200 psig.
   b. End Connections: Mechanical joint.
   c. Interior Coating: Complying with AWWA C550.

2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

   a. Minimum Working Pressure: 200 psig.
   b. End Connections: Mechanical joint.
   c. Interior Coating: Complying with AWWA C550.

B. UL/FM, Cast-Iron Gate Valves:

1. UL/FM, Nonrising-Stem Gate Valves: UL 262, FM-approved iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

   a. Minimum Working Pressure: 175 psig.
   b. End Connections: Flanged.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

1. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
2. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch- diameter barrel.

1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 CORPORATION VALVES AND CURB VALVES

A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch- diameter barrel.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.8 WATER METERS

A. Description: AWWA C700, displacement-type, bronze main case. Register flow in gallons unless cubic feet are indicated.

B. Description: AWWA C702, compound-type, bronze case. Register flow in gallons unless cubic feet are indicated.

C. Water-Meter Boxes: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.

2.9 BACKFLOW-PREVENTION DEVICES

A. General: ASSE standard, backflow preventers.

1. Working Pressure: 150 psig minimum, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body with threaded ends.
3. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

4. Interior Components: Corrosion-resistant materials.
5. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

B. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013 or AWWA C511, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves.

1. Maximum Pressure Loss: 12 psig through middle 1/3 of flow range.

D. Double-Check-Valve Backflow Prevention Assemblies: ASSE 1015 or AWWA C510, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

E. Double-Check-Valve Backflow Prevention Assemblies: UL 312, FM approved; with two UL 312, FM-approved, iron-body, 175-psig working-pressure, flanged-end check valves and two UL 262, FM-approved, iron-body, outside screw and yoke, flanged, 175-psig working-pressure gate valves.

1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

F. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

2.10 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

B. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
2. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
3. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
4. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

1. Connections: Two NPS 2-1/2 inlets and one NPS 4 NPS 6 outlet.
2. Connections: Three NPS 2-1/2 inlets and one NPS 6 outlet.
3. Inlet Alignment: Inline, horizontal .
4. Finish Including Sleeve: Polished chrome plated Rough chrome plated Polished bronze.
5. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Underground Water-Service Piping: Use any of the following piping materials for each size range:

1. NPS 3/4 to NPS 2: Soft copper tube, Type K Type L; wrought-copper fittings; and brazed soldered joints.
2. NPS 3/4 to NPS 2: PVC, PVC, Schedule 80 socket fittings; and solvent-cemented joints.
3. NPS 2-1/2 to NPS 3-1/2: Soft copper tube, Type K ; wrought-copper fittings; and brazed soldered joints.
4. NPS 2-1/2 to NPS 3-1/2: PVC, PVC, Schedule 80 socket fittings; and solvent-cemented joints.
5. NPS 4 to 16: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
6. NPS 4 to 16: PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

C. Underground Fire-Service-Main Piping: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints. Or if shown on plan, PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

D. Underground Combined Water-Service and Fire-Service-Main Piping: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints. Or if shown on plan, PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

3.2 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient seated, gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

3.3 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

H. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

I. Install PE pipe according to ASTM D 2774 and ASTM F 645.

J. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration.

K. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

L. Sleeves are specified in Division 2 Section "Utility Materials."

M. Mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Anchor service-entry piping to building wall.

3.5 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.
4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 WATER-METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written requirements.

B. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water-meter inlets. Include valves on water-meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water-meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.8 BACKFLOW-PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.9 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

C. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on two sides of each freestanding fire department connection. Refer to Division 5 Section "Metal Fabrications" for pipe bollards.

3.11 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.

B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.

C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to interior domestic-water and fire-suppression piping.

E. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer piping.

F. Connect waste piping from drinking fountains to storm-drainage system. See Division 2 Section "Storm Drainage" for connection to storm-sewer piping.

G. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.12 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

   a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
   b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
   c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 02510

SECTION 02764 - PAVEMENT 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 the following:

1. Expansion and contraction joints within portland cement concrete pavement.

B. Related Sections include the following:

1. Division 2 Section "Portland Cement Concrete Paving" for constructing joints in concrete paving.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

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.

1.4 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.

1.5 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 to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 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 (4.4 deg C).
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint 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. (Gray in Color).

2.2 COLD-APPLIED JOINT SEALANTS

A. Joint sealant shall be a one part non-priming polyurehtane sealant, gray in color. The Sealant shall conform to federal specifications TT-S_00230c, Type II, Class A.

2.3 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

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.

B. Joint Priming: Prime joint substrates where indicated or 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to 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. Install backer materials 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 backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. 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.

E. 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 joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 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.

END OF SECTION 02764

SECTION 02821 - CHAIN-LINK FENCES AND GATES

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. Chain-Link Fences: Industrial.
2. Gates: swing.

B. Related Section s include the following:

1. Division 2 Section "Earthwork" for site excavation, fill, and backfill where chain-link fences and gates are located.
2. Division 3 Section "Cast-in-Place Concrete" for concrete.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:

a. Wind Speed: 90 mph (145 km/h).
b. Fence Height: 6 feet (2m).
c. Line Post Group: IA, ASTM F 1043, Schedule 40 steel pipe.

2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet (3.66 m) high, and post spacing not to exceed 10 feet (3 m).

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.
4. Accessories: Privacy slats.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

C. Samples for Initial Selection: Manufacturer's color charts or 6-inch (150-mm) lengths of actual units showing the full range of colors available for components with factory-applied color finishes.

D. Samples for Verification: For each type of chain-link fence and gate indicated.

1. Vinyl inserts in 6-inch (150-mm) lengths.

E. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.

1. Strength test results for framing according to ASTM F 1043.

F. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

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

1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Interruption of Existing Utility Service: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect no fewer than ten days in advance of proposed interruption of utility services.
2. Do not proceed with interruption of utility services without Architect's written permission.

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. Chain-Link Fences and Gates:

a. Allied Fence Co.

b. American Fence Company, Inc.

c. First Fence Co.

d. ICR Fence Co.

e. United Fence Co.

f. Western Fence Co.

2.2 CHAIN-LINK FENCE FABRIC

A. General: height, limited to 6 feet (2 m). Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: Metallic-coated wire with a diameter of 0.148 inch (3.76 mm).

a. Mesh Size: 2 inches (50 mm).
b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 1, 2.0-oz./sq. ft. (0.61-kg/sq. m) with zinc coating applied before weaving.

c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

2. Selvage: Knuckled at both selvages.

2.3 INDUSTRIAL FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:

1. Group: IA, round steel pipe, Schedule 40.
2. Fence Height: 6 feet (1.83 m).
3. Strength Requirement: Light industrial according to ASTM F 1043.
4. Post Diameter and Thickness: According to ASTM F 1043.
5. Post Size and Thickness: According to ASTM F 1043.

a. Top Rail: 1.66 inches (42 mm).
b. Line Post: 2.375 inches (60 mm).
c. End, Corner and Pull Post: 2.875 inches (73 mm).

d. Swing Gate Post: According to ASTM F 900 2.375-inch (60-mm) diameter.

6. Coating for Steel Framing:

a. Metallic Coating:

1) Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A.

2.4 TENSION WIRE

A. General: Provide horizontal tension wire at the following locations:

1. Location: Extended along top and bottom of fence fabric.

B. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:

1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
a. Class 3: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.

2.5 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for single swing gate types.

1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
2. Metal Pipe and Tubing: Aluminum. Comply with ASTM B 429 and ASTM F 1043 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:

1. Gate Fabric Height: 2 inches (50 mm) less than adjacent fence height.
2. Leaf Width: 36 inches (914 mm).
3. Frame Members:

a. Tubular Steel: 1.66 inches (42 mm) round.

C. Frame Corner Construction:

1. Welded or assembled with corner fittings.

D. Hardware: Latches permitting operation from both sides of gate, hinges, Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.6 FITTINGS

A. General: Comply with ASTM F 626.

B. Post and Line Caps: Provide for each post.

1. Line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.

2.7 PRIVACY SLATS

A. Material: PVC, UV-light stabilized, flame resistant, 4 ply, not less than 0.023 inch (0.58 mm) thick; attached to not less than 0.0475-inch- (1.21-mm-) diameter, twisted galvanized wire; hedge-type lattice; sized to fit mesh specified for direction indicated.

B. Color: As selected by Architect from manufacturer's full range to match building color.

2.8 CAST-IN-PLACE CONCRETE

A. Materials: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94/C 94M. Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94/C 94M.

1. Concrete Mixes: Normal-weight concrete air entrained with not less than 3000-psi (20.7-MPa) compressive strength (28 days), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum size aggregate.

B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.9 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.10 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper or Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.2 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
b. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at maximum 8 feet (2.44 m) o.c., or as indicated on drawings.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 6 feet (1.83 m) or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

1. Top Tension Wire: Install tension wire through post cap loops.
2. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Bottom Rails: Install, spanning between posts.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

M. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Vertically for privacy factor of 70 to 75] <Insert privacy factor range.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

D. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

E. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.6 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 02821

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, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Slabs-on-grade.
3. Equipment pads and bases.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section "Portland Cement Concrete Paving" for concrete paving and walks.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

D. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

E. Concrete delivery tickets: A delivery ticket is required for each load of concrete and shall show the following information:

1. Number of cubic yards
2. The exact type and amount of cement, this can be indicated either by weight or volummetric quantity.
3. The amount of mixing water including free moisture in aggregates; this can be indicated either by weight or volummetric quantity.
4. If water is added at job site, (only when allowed by architect) note amount.

5. Amount of slump in inches (after addition of water, if any).
6. Type of cement.
7. Amount of air entrainment when delivered at job site.
8. Do aggregates meet ASTM specificied- yes or no. Indicate maximum size aggregate.
9. Amount and brand (or ASTM) of admixture other than air entraining agent (if any) previously approved in writing by architect.
10. Mix time.
11. Delivery date, time, and temperature.

F. Maintain all delivery tickets on the job with a copy for the Architect. If the architect is not on the site, the superintendent or foreman shall obtain these tickets and see that they are held for him/her in a particular file so they are readily available. Note exact location of concrete placement at the project by indicating grid point identification.

G. Warranty: Submit sample of proposed warranty for approval as to form.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 318, "Building Code Requirements for Reinforced Concrete."
2. ACI 301 "Specificaitons for Structural Concrete Buildings."

B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Mockup: Cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Architect's acceptance of visual qualities. Include sample of curing/sealing product with mock-up.

1. Demolish mockup and remove from site when directed by Architect.

E. Appearance Criteria: Concret exposed to view with defects which adversely affect appearance of specified finish may be repaired only by approved methods when repair work is approved by architect.

1. Concrete not exposed to view (either interior or exterior) will not be rejected for defective appearance.
2. Remove and replace architectural concrete with surface exceeding limitations.

F. Strength Criteria: Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to the following:

1. Low concrete strength.

2. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.
3. Concrete which differs from required dimensions or location in such manner as to reduce strength, curing less than that specified.
4. Inadequate protection of concrt\et from extremes of temperature during early stages of hardening and strength development.
5. Mechanical injury, construction fires, accidents or premature removal of formwork lokely to result in deficient strength.
6. Workmanship likely to result in deficient strength.

G. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.

H. Core tests may be required when strength of concrete in place is considered potentially deficient.

I. If core test are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accord with Chapter 20 of ACI 318.

J. Replace concrete work judged inadequate by structural analysis or by results of load tests, if so directed by architect/engineer.

K. Contractor shall pay all costs incurred in providing additional testing and /or analysis required.

L. Tolerance Criteria:

1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to provisions of strength requirements.
2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal. If removal of excess material is permitted, accomplish in such manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or if they interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding limits of tolerances, which are exposed to view, may be rejected. Repair or remove and replace if required.
5. Finished slabs exceeding tolerances may be repaired provided strength or appearance is not adversely affected. Remove high spots with a terrazo grinder, fill low spots with patching compound, or other remedial measures performed as permitted.

M. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

N. Reinforcement Fabrication Tolerances:

1. Sheared length: plus or minus 1inch.
2. Depth of truss bars: Plus 0, minus 1 inch.
3. Overall dimensions of stirrups, ties and spirals: Plus or minus 1/2 inch.
4. All other bends: plus or minus 1 inch.

O. Reinforcement Placement Tolerances:

1. Clear distance to formed surfaces: Plus or minus 1/4 inch.
2. Minimum spacing between bars: Minus 1/4 inch.
3. Top bars in slabs and beams:
   a. Members 8 inches deep or less: Plus or minus 1/4 inch.
   b. Members between 8 and 24 inches deep: Plus or minus 1/2 inch.
   c. Members more than 24 inches deep: Plus or minus 1 inch.
4. Crosswise members: space evenly within 2 inches.
5. Lengthwise of members: Plus or minus 2 inches.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.

   1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.
   2. Provide plastic cone snap ties for architecturally exposed concrete. Size: 1" diameter x 1" deep.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615-82 Grade 60 (ASTM A 615M Grade 400), deformed unless otherwise indicated. Epoxy coated as designated on strucural drawings.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185-79, welded steel wire fabric. Provide fabric in flat sheets, not rolls, unless otherwise acceptable to Architect/Engineer.

D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

   1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

E. Smooth Dowel Bars for Construction Joints: ASTM A 29, Grade 60.

G. Tie Wire: Use minimum 16 gauge annealed type.

H. Fabrication: Fabrication of reinforcing bars to conform to required shapes and dimensions and in compliance with CRSI Manual and ACI 315. In the case of fabricating errors, rebended or straightening of reinforcing steel will not be permitted.

1. Locate of reinforcing splices at points of minimum stress.
2. Reinforcements with any of the following defects will not be permitted in the work:
   a. Bar lengths, depths and bends exceeding specified fabrication limits.
   b. Bends or kinks not indicated on drawings or final shop drawings.
   c. Bars with reduced cross-section due to excessive rusting or other cause.

2.3 CONCRETE MATERIALS

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

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Prohibited Admixtures: Calcium Chloride Thyocyanates or admixtures containing more than 0.1 percent chloride ions.

C. Air Entrainment: ASTM C 260, certified by manufacturer to be compatible with other required admixtures. 6-1/4 % plus or minus 1-1/4%.

D. Fly Ash (Pozzolant) : May be used in concrete not exposed to weather and may not replace cement. Use is limited to 15 percent of weight of cement with a 1.5 to 1 replacement ratio, but deducted from the aggregate weight. Loss of ignition at less than 1 percent and water requirement not to exceed 100 percent.

E. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete. Concrete mix weight should be in the range of 145 to 155 pounds per cubic foot.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

F. Water: Potable, clean, drinkable.

H. Pozzolanic Admixture: ASTM C618. Use high range water reducing admixture.

K. Water-Reducing Admixture: ASTM C 494, Type A and containing not more than .I percent chloride ions.

L. High Range Water Reducing Admixture: ASTM C 494, Type F or Type G and containing not more than .1 percent chloride ions.

M. Water Reducing, Non Chloride Accelerator Admixture: ASTM C 494, Type E and containing not more than .1 percent chloride ions.

2.4 RELATED MATERIALS

A. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

B. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

C. Bonding Agent: Acrylic or Styrene Butadiene.

D. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

E. Curing and Sealing: Curing and sealing compound to be used on all exposed concrete flatwork and exterior surfaces of concrete beams, walls and columns. Two coat application occurring immediately after surface water dissipation and concrete finishing and at approx. 28 days from placement. Products to be used:

1. Curing: Dayton Superior Crete Cure Concentrate J-12 Crete Cure
   Approved equals must be submitted to Architect and approved in writing.
2. Sealing: L & M Construction Chemicals, Inc. Pentane

2.5 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability, and as approved by Engineer.

B. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

   a. 6.5 percent (moderate exposure); for 3/4 inch maximum aggregate.

2. In all other concrete, including vertical concrete walls, columns, beams and floor slabs with any portion exposed to freezing and thawing conditions, use 5 percent air-entrainment for 3/4" maximum size aggregate.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.6 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.
2. Limit use of fly ash (pozzolanic admixtures) to not exceed 15 percent of cement content by weight, with a 1.5 to 1 replacement ratio. Loss of ignition at less than 1 percent and water requirement not to exceed 100%.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. Concrete slabs on grade: 4000 psi (27.6 Mpa) and 6.0 bags, 28-day compressive strength; water-cement ratio, 0.45 maximum (non-air-entrained), 0.35 maximum (air-entrained).

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches
2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.
4. Other concrete: Not more than 4 inches (100 mm).

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.7 CONCRETE MIXING

A. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. (0.76 cu. m) or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For

mixers of capacity larger than 1 cu. yd. (0.76 cu. m), increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS :

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and

set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Submit steel producer's certificates of mill analysis including physical propoerties and chemical analysis of reinforcing steel.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Reinforcement bars are to be secured with wire ties at all points of intersection unless the spacing is less than 12 inches in each direction, in which case tie alternate points of intersection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Tack welding of reinforcing bars will not be permitted.

G. The overlapping of sheets of metal mesh is one square plus 6 inches.

H. Splicing: All reinforcement shall be furnished in the full lengths indicated on the drawings. Splicing of bars is only permitted where shown on the drawings. Stagger splices as far apart as possible. Lap bars thirty diameters minimum in making a splice. Do not bend reinforcing steel after embedding in hardened concrete, unless authorized by Architect/Engineer.

3.4 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 10 ft. in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.5 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. 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, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.6 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Architect/Engineer/Project Manager to review and approve formwork, reinforcement, etc. prior to commencement of concreting.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. (24 inches thick layers or less). If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
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 machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. 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 to segregate. Concrete to be deposites as near as possible to its final position to avoid segregation due to rehandling or flowing.
3. Concrete shall not be allowed to freefall over six (6) feet.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
3. If freezing may occur during curing period, the concrete shall be protected by means of an insulating covering and/or heating to prevent freezing for a period of not less than 10 days after placing. No combustion heating shall be allowed during the first 24 hours unless precautions are taken to prevent exposure to exhaust gases.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled 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 reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

I. Adding Water to Concrete: Do not add water to concrete without approval of Engineer/Project Manager. Account for all water added to the concrete mix.

J. Do not add water to ready-mix concrete drum unless:

1. Water is added only while the concrete is mixing in the drum.
2. The mixing truck is equipped with a revolution counter and a working water meter.
3. The delivery ticket provides all information regarding the total amount of water added to the mix.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

E. 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.

3.9 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks,

uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

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

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

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, 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 shown or required to complete Work.

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

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water. (water ponding).
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.14 REUSING FORMS

A. 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-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas 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.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces 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. Proprietary underlayment compounds may be used when acceptable to Architect.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports. All laboratory testing and special inspections services will be performed at no cost to the Contractor except for testing specified in "Duties of Contractor" and "Additional Testing".

B. The Owner's paying for testing and servics does not relieve the Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Failure to identify any defective work or material does not prevent later rejection when such defect is discovered, nor obligate Architect/Engineer for final acceptance.

D. The testing agency employed by the Owner will meet the requirements of ASTM E329.

E. To facilitate testing and inspection, Contractor will:

1. Furnish labor to assist testing agency in obtaining and handling samples at site or sources of materials.
2. Advise testing agency sufficiently in advance of operations to allow for completion of quality tests and assignment of personnel.
3. Provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on site for 24 hours as required by ASTM C 31.

F. Contractor is responsible for all retesting and remedial work required as a result of failed tests.

G. Sampling and testing for quality control during concrete placement will include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

    a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
    d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Core Tests: Obtain and test cores in accord with ASTM 42.

1. If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F relative humidity less than 60 percent) for 7 days before test.

2. Test dry.

3. If concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning.

4. Take at least three representative cores from each member or area of concrete in place that is considered potentially different.

5. Location determined by Architect/Engineer so as least to impair strength of structure.

6. If, before testing, one or more of cores shows evidence of having been damaged subsequent to or during removal from structure, replace it.

7. Concrete in area represented by a core test will be considered adequate if average strength of concrete of cores is equal to at least 85 percent of and if no single core is less than 75 percent of specified strength (f`c). Fill core holes with low slump concrete or mortar and finish surface to match adjacent concrete.

F. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

G. Concrete Protection: Contractor is responsible to protect concrete from freezing, oil, grease, staining or defacement of any kind until it has set. If such protection is not provided, Contractor shall be responsible for removing and replacing concrete at own expense.

3.17 WARRANTY

A. Provide writtem warranty for concrete work, in form approved by Architect, to promptly repair and/or replace defective concrete as directed by the Owner and /or Architect at the contractor's expense. Defective concrete is defined as concrete failure due to pitting, spalling, flaking or cracking (cracks which exceed 1/16 inch width), or cracks which occur due to inadequate or untimely crack control proceedures as determined by the Architect. Defective work also includes concrete that does not meet Class A finish quality, or tolerances specified. New replacement work is required to be warranted according to terms of original warranty starting at date of replacement.

1. Terms of Warranty: Two (2) years starting from date of substantial completion.
2. Submit written warranty to Architect for approval as to form.

END OF SECTION 03300

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 framing and supports for countertops.
2. Miscellaneous steel trim including stainless steel bent plate corner guards.
3. Bollards.

B. Related Sections include the following:

1. Division 5 Section "Pipe and Tube Railings."

1.3 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.5 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.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for 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. 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.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 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. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 FASTENERS

A. General, where indicated or required: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with

ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. 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.

E. 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 (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. 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.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from 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. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from 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.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe as indicated.

1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate, where indicated.
2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.10 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.

2.11 STEEL AND IRON FINISHES

A. 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. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Shop Priming: 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: Shop, Field, and Maintenance Painting of Steel," for shop painting.

   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 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 Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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.

B. 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.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

D. 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 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.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete, in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded 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 (0.05-mm) 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 painting Sections.

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 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe railings.

B. Related Sections include the following:

1. Division 3 Section "Cast-In-Place Concrete" for installing steel tube railings in concrete.
2. Division 9 Section "Painting" for painting exterior railings fabricated from pipes.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Bottom Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings, where applicable.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products 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: For professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

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 Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Sharpe Products.
c. Wagner, R & B, Inc.; a division of the Wagner Companies.
d. Qualified local fabrication shop.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

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

2.4 FASTENERS

A. General: Provide the following:

1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Railings may be welded if shop fabricated.

D. Anchors: Provide cast-in-place, chemical or torque-controlled expansion anchors, where indicated, fabricated from corrosion-resistant materials 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.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. 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.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:

1. As detailed.

K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings or welded caps.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work, where indicated. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

E. 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 railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

F. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. At contractor's option, use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, or

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.

3.4 ANCHORING RAILING ENDS

A. Where indicated, anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.5 ATTACHING HANDRAILS TO WALLS

A. Where indicated, attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.6 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 same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05521

SECTION 06105 - MISCELLANEOUS 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. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Wood furring and grounds.
5. Sheathing.
6. Plywood backing panels.

1.3 DEFINITIONS

A. 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. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.4 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 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, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
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 (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:

1. Plywood: DOC PS 1.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
4. Factory mark panels according to indicated standard.

2.2 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).

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, or omit marking and provide certificates of treatment compliance issued by inspection agency.

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 (460 mm) above grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Exterior type for exterior locations and where indicated.
4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

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.

B. Non-Load-Bearing Interior Partitions or low walls: Construction, Stud, or No. 2 grade and the following species:
1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
2. Western woods; WCLIB or WWPA.

C. Other Framing: Construction or No. 2 grade and any of the following species:

1. Douglas fir-larch; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following, where indicated:

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 15 percent maximum moisture content and the following species:
1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
2. Western woods; WCLIB or WWPA.

2.6 PANEL PRODUCTS

A. Miscellaneous Concealed Plywood: Exterior sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

B. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

C. Miscellaneous Exposed Plywood: DOC PS 1, A-D Interior, thickness as indicated but not less than 1/2 inch (13 mm).

D. 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 3/4 inch (19 mm) 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 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. Power-Driven Fasteners: CABO NER-272.

C. Wood Screws: ASME B18.6.1.

D. 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.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A, Property Class 4.6; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. 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 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.8 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and acceptable to authorities having jurisdiction.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit 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.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 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- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

3.3 PANEL PRODUCT INSTALLATION

A. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

1. Comply with "Code Plus" provisions in above-referenced guide.

B. Hardboard Underlayment: Comply with AHA's "Application Instructions for Basic Hardboard Products" and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.

END OF SECTION 06105

SECTION 06200 - FINISH 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. Interior standing and running trim for field-painted finish.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 6 Section "Interior Architectural Woodwork" for shop-fabricated interior woodwork.
3. Division 9 Section "Painting" for priming and backpriming of finish carpentry.

1.3 DEFINITIONS

A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NHLA - National Hardwood Lumber Association.
3. NLGA - National Lumber Grades Authority.
4. RIS - Redwood Inspection Service.
5. SCMA - Southern Cypress Manufacturers Association.
6. SPIB - Southern Pine Inspection Bureau.
7. WCLIB - West Coast Lumber Inspection Bureau.
8. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

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. Primed Hardboard Trim, as required to match existing:

a. ABT Co.; a Louisiana-Pacific Company.
b. Georgia-Pacific Corp.
c. Temple-Inland Forest Products Corp.

2.2 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.

2.3 INTERIOR STANDING AND RUNNING TRIM

A. Lumber Trim for Opaque Finish (Painted), as required to match existing: Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:

1. Grade D Select eastern white pine; NELMA or NLGA.
2. Grade D Select Idaho white, lodgepole, ponderosa, or sugar pine; NLGA or WWPA.
3. Grade D Select white woods; WWPA.
4. Grade Superior or C & Btr finish, Douglas fir-larch or Douglas fir south; NLGA, WCLIB, or WWPA.
5. Primed Hardboard Trim.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

B. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use.

1. Use wood glues that have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.

B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
1. Interior standing and running trim, except shoe and crown molds.

C. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius, or as required to match existing trim and sills.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

1. Install trim after gypsum board joint finishing operations are completed.
2. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 06200

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

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. Plastic-laminate countertops.
2. Stainless steel countertops.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for wood framing, sheathing, furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
4. Apply WIC-certified compliance label to first page of Shop Drawings.

B. Samples for Verification: For the following:
1. Plastic-laminate-clad panel products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

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.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed architectural woodwork 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. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork

D. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide WIC-certified compliance certificate indicating that woodwork complies with requirements of grades specified.
2. Provide WIC-certified compliance certificate for installation.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field

measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Med Ex Board.

C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

a. Formica Corporation.
b. Wilsonart International; Div. of Premark International, Inc.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

F. Stainless Steel: ASTM A 666, with No. 4 finish (directional satin finish) on exposed surfaces.

G. Stainless Countertops

1. Provide countertops as indicated to meet the following:
a. Material: 304 stainless steel with a number 4 brush finish.
b. Form edges and returns as indicated with no sharp edges or burrs.

2.2 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

E. Complete fabrication, including assembly and finishing to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.4 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with WIC Section 15.

B. Grade: Premium.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: HGS
2. Vertical Surfaces: HGS
3. Edges: HGS

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Match Architect's sample.

2.5 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with WIC Section 16.

B. Grade: Premium.

C. High-Pressure Decorative Laminate Grade: HGS.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Match Architect's sample.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Med Ex Board or exterior grade plywood.

G. Core Material at Sinks Med Ex Board or exterior-grade plywood.

2.6 STAINLESS STEEL COUNTERTOPS
1. Top Construction:

a. Material: Stainless steel, Type 304, 0.0625-inch (1.6-mm) specified thickness, reinforced and sound deadened.
b. Back Splash: 4 inches (101.6 mm).
c. Edge: Bullnose on front edge, straight on sides and back.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

F. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

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. Concealed building insulation.
2. Vapor retarders.

B. Related Sections include the following:

1. Division 6 Section Miscellaneous Carpentry for insulation in wood framed walls.
2. Division 7 Section Roofing for insulation specified as part of roofing construction.
3. Division 9 Section "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
4. Division 15 Sections "Duct Insulation," "Equipment Insulation," and "Pipe Insulation."

1.3 SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.4 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.

1.5 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.

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. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Johns Manville Corporation.
c. Knauf Fiber Glass.
d. Owens Corning.

2. Slag-Wool-/Rock-Wool-Fiber Insulation:

a. Fibrex Insulations Inc.
b. Owens Corning.
c. Thermafiber.

2.2 INSULATING MATERIALS (Select from the following)

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. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass, slag wool, or rock wool.

2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS

A. Where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UBC Standard 26-9 and UL 2079 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

2.4 VAPOR RETARDERS

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. Reinforced-Polyethylene Vapor Retarders:

a. Raven Industries, Inc.; DURA-SKRIM 6WW.
b. Reef Industries, Inc.; Griffolyn T-65.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

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 (2438 mm), 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. Stuff glass-fiber or mineral fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

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 (406 mm) o.c.

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

E. 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.

F. 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 07311 – ASPHALT SHINGLES

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 35 year architectural grade asphalt shingles, underlayments and existing asphalt shingles and underlayment tear-off.

B. Related Sections:

1. Division 01 Section "Unit Prices" for unit price to remove and replace existing damaged roof sheathing uncovered during existing roofing tear-off.
2. Division 06 Section "Miscellaneous Rough Carpentry" for wood framing and sheathing.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings, flashings and rain gutters.

1.3 SUBMITTALS

A. Samples for initial selection in the form of manufacturer's sample finishes showing colors and profiles to match the existing asphalt shingles on Building 5100.

B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

C. 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.

D. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

E. Owner's (DFCM) Standard Sample Roofing Warranty.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Classification: Where products with a fire-test-response classification are specified, provide asphalt shingles identical to those tested according to ASTM E 108 or UL 790 and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify each bundle of asphalt shingles with appropriate markings indicating fire-test-response classification of applicable testing and inspecting agency.

B. Wind-Resistance-Test Characteristics: Where wind-resistant asphalt shingles are indicated, provide products identical to those tested according to ASTM D 3161 or UL 997 and passed. Identify each bundle of asphalt shingles with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's unopened bundles or containers with labels intact.

B. Handle and store materials at Project site to prevent water damage, staining, or other physical damage. Store roll goods on end. Comply with manufacturer's recommendations for job-site storage, handling, and protection.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installing asphalt shingles only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements, and when substrate is completely dry.

1.7 WARRANTY

A. Owner’s Standard Roofing Warranty: Refer to the Owner’s Standard Roofing Warranty to be signed and submitted at the conclusion of the successful roofing installation.

B. Special Project Warranty: Roofing Installer's Warranty, or warranty form at end of this Section, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion, unless otherwise required by Owner.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Furnish 1 square (9.29 sq. m) coverage of asphalt shingles, identical to those to be installed, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide asphalt shingles produced by one of the following:

1. (The) Celotex Corporation.
2. CertainTeed Corporation.
3. GAF Building Materials Corporation.
4. Georgia-Pacific Corp.
5. Owens-Corning Fiberglas Corp.

B. Waterproof Underlayment:

a. WinterGuard; CertainTeed Corporation.
b. Bituthene Ice and Water Shield; Grace: W.R. Grace & Co.
c. Nordshield Ice and WaterGard; Nord Bitumi US, Inc.
d. Polyguard Deck Guard; Polyguard Products, Inc.
e. Weather Watch; GAF Building Materials Corporation.

2.2 ASPHALT SHINGLES

A. Colors, Blends, and Patterns: Where manufacturer's standard products are indicated, provide asphalt shingles with the following requirements:

1. Match existing asphalt shingles currently installed on Building 5100.

B. 50 year, Three-Dimensional, Fiberglass, Laminated Strip Shingles, to match shingles on Building 5100: Mineral-surfaced, self-sealing, laminated, multi-ply overlay construction, fiberglass-based, strip asphalt shingles, complying with both ASTM D 3018, Type I, and ASTM D 3462. Provide shingles with a Class A fire-test-response classification that pass the wind-resistance-test requirements of ASTM D 3161.

1. Wind Resistance: Passes the wind-resistance-test requirements of ASTM D 3161.
2. Fire-Test-Response Classification: Class A.

2.3 METAL TRIM AND FLASHING

A. Sheet Metal Materials: Furnish the following sheet metal materials where indicated:
1. Galvanized-Steel Sheets: ASTM A 526, G 90 (ASTM A 526M, Z 275) hot-dip galvanized steel with coating designation according to ASTM A 525 (ASTM A 525M), mill phosphatized where indicated for painting; 0.0217 inch (0.55 mm) thick, unless otherwise indicated.

B. Metal Drip Edge: Brake-formed sheet metal with at least a 2-inch (50-mm) roof deck flange and a 1-1/2-inch (38-mm) fascia flange with a 3/8-inch (9.6-mm) drip at lower edge. Furnish the following material in lengths of 8 or 10 feet (2.5 to 3 m).
1. Material: Aluminum sheets.

C. Metal Flashing: Job-cut to sizes and configurations required.
1. Material: Galvanized-steel sheets.

D. Open-Valley Metal Flashing, where required to match Building 5100: Preformed, inverted "V" profile at center of valley and extending at least 9 inches (230 mm) in each direction from centerline of valley.
   1. Material: Galvanized-steel sheets.

E. Vent Pipe Flashing: Lead conforming to ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick, unless otherwise indicated. Provide lead sleeve sized to slip over pipe, soldered to skirt at slope of roof extending at least 4 inches (100 mm) from pipe onto roof.

2.4 ACCESSORIES

A. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil- (0.76- to 1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

   1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Carlisle Coatings & Waterproofing, Inc.
      b. Grace, W. R. & Co. - Conn.
      c. Henry Company.

B. Felt: ASTM D 226, Type I, asphalt-saturated organic felts, nonperforated.

C. Asphalt Plastic Cement: Nonasbestos fibrated asphalt cement, complying with ASTM D 4586.

D. Nails: Aluminum or hot-dip galvanized steel, 0.120-inch- (3-mm-) diameter barbed shank, sharp-pointed, conventional roofing nails with a minimum 3/8-inch- (9.5-mm-) diameter head and of sufficient length to penetrate 3/4 inch (19 mm) into solid decking or at least 1/8 inch (3 mm) through plywood sheathing.

   1. Where nails are in contact with flashing, prevent galvanic action by providing nails made from the same metal as that of the flashing.
   2. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate for compliance with requirements for substrates, installation tolerances, and other conditions affecting performance of asphalt shingles. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with noncorrosive roofing nails.

B. Coordinate installation with flashings and other adjoining work to ensure proper sequencing. Do not install roofing materials until all vent stacks and other penetrations through roof sheathing have been installed and are securely fastened against movement.

3.3 INSTALLATION (Match roofing installation at Building 5100)

A. General: Comply with manufacturer's instructions and recommendations but not less than those recommended by ARMA's "Residential Asphalt Roofing Manual" or "The NRCA Steep Roofing Manual."

1. Fasten asphalt shingles to roof sheathing with nails.
2. Fasten asphalt shingles to roof sheathing with either roofing staples, applied pneumatically, or nails.

B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.

1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.

C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
2. Eaves: Extend from edges of eaves 24 inches (600 mm) minimum beyond interior face of exterior wall.
3. Rakes: Extend from edges of rake 24 inches (600 mm) minimum beyond interior face of exterior wall.
4. Valleys: Extend from lowest to highest point 18 inches (450 mm) on each side.
5. Ridges: Extend 36 inches (914 mm) on each side.
6. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches (450 mm) minimum, and return vertically against penetrating element not less than 4 inches (100 mm).

D. Underlayment at Closed Valleys: Center a 36-inch- (900-mm-) wide waterproof underlayment in valley and secure with only enough nails to hold in place until asphalt shingles are installed. Lap roof underlayment over valley underlayment at least 6 inches (150 mm).

3.4 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.

C. Step Flashings: Install with a headlap of 2 inches (50 mm) and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.

D. Cricket Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

E. Open-Valley Flashings, where required to match adjacent Building 5100: Install centered in valleys, lapping ends at least 8 inches (200 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.

1. Secure hemmed flange edges into metal cleats spaced 12 inches (300 mm) apart and fastened to roof deck.
2. Adhere 9-inch- (225-mm-) wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.

F. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

G. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.5 ASPHALT SHINGLE INSTALLATION

A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 1/2 inch (13 mm) over fasciae at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

E. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.

F. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.

1. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.

G. Woven Valleys, where required to match Building 5100: Extend succeeding asphalt shingle courses from both sides of valley 12 inches (300 mm) beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.

1. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.

H. Closed-Cut Valleys, where required to match Building 5100: Extend asphalt shingle strips from one side of valley 12 inches (300 mm) beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (50 mm) short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

1. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.

I. Open Valleys, where required to match Building 5100: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

1. Set valley edge of asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.
2. Do not nail asphalt shingles to metal open-valley flashings.

J. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

3.6 ADJUSTING

A. Replace any damaged materials installed under this Section with new materials that meet specified requirements.

END OF SECTION 07311

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 where indicated or required:

1. Manufactured reglets.
2. Formed steep-slope roof flashing and trim.
3. Formed wall flashing and trim.
4. Formed equipment support flashing, not specified by other Divisions.

B. Related Sections include the following:

1. Division 7 Section Asphalt Shingles for installing sheet metal flashing and trim integral with roofing shingles.
2. 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. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) 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 (67 deg C), ambient; 180 deg F (100 deg C), 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. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

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 SHEET METALS

A. Zinc-Coated (Galvanized) Steel Sheet, where indicated to match existing material: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting.

B. Prepainted, Metallic-Coated Steel Sheet, where indicated to match existing material: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Exposed Finishes: Apply the following coil coating:

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604 , except as modified below:

a) Humidity Resistance: 1000 hours.
b) Salt-Spray Resistance: 1000 hours.

2) Color: As selected by Architect from manufacturer's full range.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) 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. (0.16 kg/sq. m).

2.3 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. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets, whrere indicated: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Available Manufacturers:

   a. Cheney Flashing Company, Inc.
   b. Fry Reglet Corporation.
   c. Heckmann Building Products Inc.

2. Material: Galvanized steel, 0.0217 inch (0.55 mm) 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, where indicated: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type, where indicated: 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, where indicated: 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.

2.5 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 (25 mm) 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.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

B. Valley Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

C. Drip Edges: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

E. Counterflashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

F. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing, where required: Fabricate from the following material:

1. Galvanized Steel, where unexposed to view: 0.0276 inch (0.7 mm) thick.
2. Prepainted, Metallic-Coated Steel, where exposed to view: 0.0276 inch (0.7 mm) thick.

2.8 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 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 concealed within joints. 12 inches (300 mm) 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 (3 m) with no joints allowed within 24 inches (600 mm) 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 (25 mm) deep, filled with elastomeric sealant

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) 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 (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), 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 (4 deg C).
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 (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel sheet.
2. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
4. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
5. 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.

3.3 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, where required: 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 16-inch (400-mm) centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

D. 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 (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 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.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans, where indicated or required: 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.

C. Replace existing damaged flashings or flashings required to be removed during existing asphalt shingle repair and replacement.

3.6 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 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 (ES-3).
   b. Control and expansion joints in unit masonry (ES-3).
   c. Joints between different materials listed above (ES-3).
   d. Perimeter joints between materials listed above and frames of doors and windows (ES-1).
   e. Metal panels to concrete slabs (ES-1).

2. Exterior joints in the following horizontal traffic surfaces:

   a. Joints between different materials listed above (ES-4).

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Perimeter joints of exterior openings where indicated (ES-3).
   b. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions (ES-3).
   c. Joints on underside of cast-in-place concrete beams (ES-3).
   d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances (ES-3).
   e. Joints between plumbing fixtures and adjoining walls, floors, and counters (ES-2).
   f. Metal panels to masonry walls and concrete slabs (ES-3).

4. Interior joints in the following horizontal traffic surfaces:

   a. Control and expansion joints in cast-in-place concrete slabs (ES-4).

C. Related Sections include the following:

1. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
2. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
3. Division 8 Section "Glazing" for glazing sealants.

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

A. Product Data: For each joint-sealant product indicated. Submit list of all sealants to be used prior to installation for written approval of each sealant type by Architect.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.

E. Warranties: Special warranties specified in this Section.

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. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

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 (4.4 deg C).
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: 10 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 of sealant:

ES-1: Multicomponent Nonsag Neutral-Curing Silicone Sealant, equal to Dow Corning Corporation; 756 H.P.

ES-2: Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant, equal to Dow Corning Corporation; 786 Mildew Resistant.

ES-3: Multicomponent Nonsag Urethane Sealant Pecora Corporation, equal to Pecora Corporation; Dynatrol II.

ES-4: Multicomponent Nonsag Immersible Urethane Sealant, equal to Pecora Corporation; Dynatred.

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.

2.7 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. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. 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 (minus 32 deg C). 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.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 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. Masonry.
    c. 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. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

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.
4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, to produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant to comply with sealant manufacturer's written instructions.

3.4 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.

3.5 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.

END OF SECTION 07920

SECTION 08111 - STANDARD 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. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for removal and replacement of existing doors, frames, and hardware.
2. Division 6 Section "Miscellaneous Carpentry" for wood framed walls and partitions.
3. Division 8 Section "Glazing" for glazed lites in standard steel doors.
4. Division 8 Sections for door hardware for standard steel doors.
5. Division 9 Section "Gypsum Board Assemblies" for frames in gypsum board faced walls and partitions.
6. Division 9 painting Sections for field painting standard steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

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. Details of glazing frames and stops showing glazing.
8. Details of conduit and preparations for electrified door hardware and controls.

C. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Door Frame 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.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify 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 standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. 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 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. Ceco Door Products; an ASSA ABLOY Group Company.
2. CURRIES Company; an ASSA ABLOY Group Company.
3. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
4. Mesker Door Inc.
5. Pioneer Industries, Inc.
6. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

G. Powder-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 standard steel door frames of type indicated.

H. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

J. Glazing: Comply with requirements in Division 8 Section "Glazing."

K. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
   b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) when tested according to ASTM C 1363.

      1) Locations: Exterior doors and interior doors where indicated.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

   a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 Full Flush.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
2. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
2. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
3. Frames for Wood Doors: 0.067-inch- (1.7-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:

1. Masonry Type, where indicated: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry, where indicated: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.

J. Plaster Guards: Formed from same material as frames, not less than 0.016-inch (0.4-mm) thick.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.

2.6 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
3. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        2) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) in height.
        3) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 120 inches (3048 mm) in height.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        2) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
        3) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
        4) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

D. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.7 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel 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.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

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 standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors, sidelights and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

SECTION 08143 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior French and Sash, Stile and Rail wood doors.
2. Priming stile and rail wood doors.
3. Fitting stile and rail wood doors to frames and machining for hardware.

B. Related Sections:

1. Division 09 Section "Exterior Painting" for field finishing stile and rail doors.

1.3 SUBMITTALS

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

1. Include details of construction and glazing.
2. Include factory finishing specifications.

B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Dimensions of doors for factory fitting.
2. Locations and dimensions of mortises and holes for hardware.
3. Doors to be factory finished, and finish requirements.

C. Product Certificates: For each type of door, from manufacturer.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain stile and rail wood doors from single manufacturer.

C. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions and requirements of quality standard referenced in Part 2.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 17 and 50 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.

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. Exterior Doors: Five years.
b. Insulating Glass Vision Panels: Five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use only materials that comply with referenced standards and other requirements specified.

1. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.

C. Panel Products: Any of the following:

1. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2.
2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade 130.
4. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.

2.2 EXTERIOR STILE AND RAIL WOOD DOORS

A. Exterior French and Sash Stile and Rail Wood Doors: Stock exterior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Simpson Door Company, #7118, Fir/Hemlock with ¾" clear tempered insulated glass, or comparable product by one of the following:

   a. Belentry Doors LLC.
   b. International Door and Latch.
   c. Jeld-Wen, Inc.
   d. Karona, Inc.
   e. McPhillips Manufacturing Company.
   f. Northwest Door Inc.
   g. QSM Doors, Inc.
   h. Approved Equal.

2. Finish and Grade: Opaque and Standard.
3. Wood Species: Manufacturer's standard Fir/Hemlock softwood species and cut.
4. Stile and Rail Construction: Edge-glued solid lumber or veneered, structural composite lumber or veneered edge- and end-glued lumber.
5. Panel Construction: Edge-glued solid lumber or veneered panel product.
6. Raised-Panel Thickness: 1 7/16" or Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated.
7. Molding Profile (Sticking): Manufacturer's standard.
8. Glass: Uncoated, clear, fully tempered float glass, insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with minimum 1/4-inch (6.4-mm) interspace complying with Division 08 Section "Glazing."
9. WDMA Design Group: 1-3/4 Thermal (Insulated-Glass) Doors (Exterior).

10. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.

11. Door Construction for Opaque Finish:

a. Stile and Rail Construction: Clear softwood; may be edge glued for width and finger jointed.
b. Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber.
c. Raised-Panel Construction: Clear softwood lumber; edge glued for width.
d. Raised-Panel Construction: Veneered, wood-based panel product.

2.3 STILE AND RAIL WOOD DOOR FABRICATION

A. Fabricate stile and rail wood doors in sizes indicated for field fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:

1. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch (10 mm) 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 (3-1/2 degrees) at lock and hinge edges.

C. 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.

D. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable. Miter wood moldings at corner joints.

E. Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 08 Section "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.

F. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.4 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section "Exterior Painting." Seal all four edges, edges of cutouts, and mortises with primer.

2.5 FINISHING

A. Primer wood doors at factory or woodworking shop.

B. Finish wood doors at factory or woodworking shop where indicated in schedules or on Drawings. Wood doors that are not indicated to be factory finished may be field finished.

1. Finish faces and all four edges of doors, including mortises and cutouts.

C. Opaque Finish:

1. Grade: Premium.
2. Color: As selected by Architect.
3. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors will be installed.

1. Verify that installed 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 08 Section "Door Hardware."

B. Install wood doors to comply with manufacturer's written instructions, WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and other requirements specified.

C. Field-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 with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/4 inch (6 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6 mm) from bottom of door to top of threshold.

a. Comply with NFPA 80 for fire-rated doors.

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 08143

SECTION 08300 - SPECIAL 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. Monolithically formed, insulated, high impact door systems for interior applications.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry" for prepared opening with wood jambs and header trim.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Show fabrication details. Indicate location, size, elevation of each kind of door; location and extent of hardware blocking, gaskets, glazing types and details, security features; attachment to other work and materials to be furnished and installed by others, and other pertinent data.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. High impact plastic Door Faces: Show the full range of colors, textures, and patterns available.

D. Samples for Verification:

1. Full range of manufacturer's standard color and material selections for panels.

E. Quality Assurance/Control Submittals:
1. Manufacturer's Installation Instructions.

F. Closeout submittals:
1. Cleaning and Maintenance instructions for each door type.
2. Warranty for each door type.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain impact traffic and impact security doors through one source from a single manufacturer.

B. Manufacturer Qualifications: Minimum 5 years experience in producing each door of the type specified.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Deliver product in manufacturer's original unopened packages with labels intact..

C. Examine doors upon delivery for damage. Verify doors were shipped on edge or in upright position as indicated on packaging by manufacturer.
   1. Note specific doors shipped in other than on edge or upright position on bill of lading and contact manufacturer.

D. Store doors at project site on edge or in upright position and under cover following manufacturer's instructions printed on carton.

1.6 PROJECT CONDITIONS

A. Frames installed under other sections shall be level and plumb.

B. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 humidity range percent during the remainder of the construction period.

1.7 WARRANTY

A. Two years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer:

   1. Eliason Corporation, P.O. Box 2128, Kalamazoo, MI 49003; (800) 828-3655; fax (800) 828-3577; email:doors@eliasoncorp.com; www.eliasoncorp.com; or approved equal.
      a. Interior Impact Traffic Door: Eliason model HCP-10.

2.2 DOOR CONSTRUCTION, GENERAL

A. Interior Heavy Impact Traffic Door:

1. Door Panel: shall be monolithic, one piece, hollow shell of high impact, thermoplastic facing with minimum wall thickness of 1/8 inch, overall panel thickness of 1-1/2 inches, and textured finish. Bottom, leading and back edges have molded in keyways to accept gaskets.
2. Door Panel Core: shall be of high strength polymer cell core.
   a. Standard hinge system: Double action Easy Swing hinges with Zinc coated finish.
3. Vision Panel: Window glazing shall be clear double glazed acrylic. Minimum height from finish floor to the bottom of the viewing area shall not exceed 48 inches.
4. Lower hinge guard: 5 inch by 18 inch, to protect the jamb and lower hinge from passing loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work and opening dimensions and clearances are as indicated on drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory conditions.

C. Commencement of work by installer is acceptance of opening conditions.

3.2 INSTALLATION

A. Install special doors complete with necessary hardware and accessories in accordance with final shop drawings, manufacturer's instructions and as specified herein.

B. All assemblies must be installed plumb, level and properly aligned.

C. Upon completion of installation, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion.

D. Install doors accurately in their respective frames with clearances, necessary anchors, hardware and accessories according to the manufacturer's data and as specified.

E. Hardware: For installation, see Division 8 Section "Door Hardware."

F. Follow manufacturer's instructions. Coordinate sequence of installation with other work to avoid delays.

3.3 ADJUSTING

A. Operation: Re-hang 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.

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from site.

END OF SECTION 08300

SECTION 08511 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes operable aluminum-framed windows for exterior locations at Building 5080.

B. Related Sections include the following:

1. Division 08 Section "Steel Windows" for coordinating finish among exterior fenestration units.

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

1. C: Commercial.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:

1. Size indicated on Drawings.

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

   a. Basic Wind Speed: 90 mph (40 m/s).
   b. Exposure Category: C.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

D. Thermal Movements: Provide aluminum windows, including anchorage, 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 joint sealants, 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 (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

1. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.

9. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
10. Window System Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
11. Wiring Diagrams: Power, signal, and control wiring.
12. For installed products indicated to comply with design loads, include structural analysis data prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of aluminum windows and used to determine the following:

    a. Structural test pressures and design pressures from wind loads indicated.
    b. Deflection limitations of glass framing systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Qualification Data: For Installer, manufacturer, professional engineer and testing agency.

F. Field quality-control test reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

H. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for aluminum windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' 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.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional 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.

F. 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.

G. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA-certified aluminum windows with an attached label.

H. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window 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 aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: Three years from date of Substantial Completion.
b. Glazing: 10 years from date of Substantial Completion.
c. Metal Finish: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Columbia Windows and Doors, Columbia Series 3000, Thermal Break Single Hung Primary Aluminum Window with Low-E glazing, or a comparable product by one of the following:

1. All Seasons Windows & Doors; All Seasons Commercial Division, Inc.
2. EFCO Corporation.
3. Kawneer; an Alcoa Company.
4. Thermal Windows, Inc.
5. TRACO.
6. Wausau Window and Wall Systems.
7. Winco Window Company.
8. Window Technologies, Inc.; Century Manufacturing, Inc.
9. Approved equal.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

F. Replaceable Weather Seals: Comply with AAMA 701/702.

G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

A. Window Type: Single hung.

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101-93.
1. Performance Class and Grade: C40.

C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

D. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.

1. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) or less.

E. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.50, determined according to NFRC 200 procedures.

F. Sound Transmission Class (STC): Provide glazed windows rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

G. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.

1. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).

H. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.

1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).

I. Forced-Entry Resistance: Comply with Performance Grade 30 requirements when tested according to ASTM F 588.

J. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.

K. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

2.4 GLAZING

A. Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

B. Glass Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface.

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance.

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows,

and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze, extruded, cast, or wrought aluminum, die-cast zinc with special coating finish or nonmagnetic stainless steel.

B. Counterbalancing Mechanism: Comply with AAMA 902.

1. Sash Balance: Concealed, of size and capacity to hold sash stationary at any open position.

C. Sill Cap/Track: Extruded-aluminum track with manufacturer's standard factory finished color, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

E. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.

1. Locking mechanism and handles for manual operation.
2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.

F. Single-Hung Windows: Provide the following operating hardware:

1. Sash Balances: Two per sash.
2. Handles: Applied sash lift bar on bottom rail of forward-placed operating sash; two per sash.
3. Sash Lock: Cam-action sweep lock and keeper on meeting rail; two per sash.
4. Removable Lift-Out Sash: Design windows and provide with tamperproof, key-operated hardware to permit removal of sash from inside for cleaning.

2.6 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on outside of window and provide for each operable exterior sash or ventilator.

1. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Architectural C-24 class.

B. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.

1. Wire-Fabric Finish: Charcoal gray.

2.7 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.

H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.

2.8 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. 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.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-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 AAMA 2604 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Manufacturer's standard Bronze color, to match Building 5100.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

F. Connect automatic operators to building electrical system.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.
2. Testing Extent: Three windows as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
3. Test Reports: Shall be prepared according to AAMA 502.

C. Remove and replace noncomplying aluminum window and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline

deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 08511

SECTION 08711 - DOOR HARDWARE

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.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for a fire-rated labeled assembly and for door silencers provided as part of the frame.
2. Division 8 Section "Access Doors" for access door hardware, except cylinders.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. 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. 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. Locks and latches.
c. Bolts.
d. Exit devices.
e. Cylinders and keys.
f. Operating trim.

g. Closers.
h. Stops and holders.
i. Door gasketing.
j. Thresholds.
k. Kickplates.
l. Sweeps.
m. Push / Pulls.

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.

C. 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.

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.

D. 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.

E. 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.

F. 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.

G. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. 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.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. 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)," 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.

C. 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.

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 Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

B. 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.

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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 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.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and as indicated on Drawings/Hardware Schedule.

2.2 HINGES AND PIVOTS

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. Hinges:
   a. Bommer Industries, Inc. (BI).
   b. Hager.
   c. Approved equal.

C. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.
3. Self-Closing Hinges and Pivots: BHMA A156.17.
4. Pivots: BHMA A156.4.

D. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. Mechanical Locks and Latches:

   a. Schlage Lock Company; an Ingersoll-Rand Company (SCH).
   b. Best.
   c. Hager.
   d. Approved equal.

B. Standards: Comply with the following:

1. Bored Locks and Latches: BHMA A156.2.
2. Mortise Locks and Latches: BHMA A156.13.
3. Interconnected Locks and Latches: BHMA A156.12.
4. Auxiliary Locks: BHMA A156.5.
5. Exit Locks: BHMA A156.5.

C. Certified Products: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

D. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Bored Locks: BHMA A156.2.
2. Mortise Locks: BHMA A156.13.

E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Bored Locks: Minimum 1/2-inch (12.7-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.4 DOOR BOLTS

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 Bolts:
   a. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
   b. Approved equal.

C. Standards: Comply with the following:

1. Automatic and Self-Latching Flush Bolts: BHMA A156.3.
2. Manual Flush Bolts: BHMA A156.16.

D. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Half-Round Surface Bolts: Minimum 7/8-inch (22-mm) throw.
2. Interlocking Surface Bolts: Minimum 15/16-inch (24-mm) throw.
3. Fire-Rated Surface Bolts: Minimum 1-inch (25-mm) throw; listed and labeled for fire-rated doors.

2.5 EXIT DEVICES

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. Von Duprin; an Ingersoll-Rand Company (VD).
2. Hager.
3. Approved equal.

C. Standard: BHMA A156.3.

1. BHMA Grade: Grade 1.

D. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

E. 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.

F. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

G. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid.

2.6 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:

a. Best.
b. Match existing – Owner’s standard.

C. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.
2. Key Control System: BHMA A156.5.

D. Cylinder Grade: BHMA Grade 1.

E. 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.

F. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. 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.
b. Furnish permanent cores to Owner for installation.

G. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Master Key System: Cylinders are operated by a change key and a master key.

a. Cylinders shall be master keyed.

H. 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.

I. 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. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
2. Capacity: Able to hold keys for 150 percent of the number of locks.
3. 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.

2.7 STRIKES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Electric Strikes, where indicated: See Hardware Schedule on drawings.

    a. Von Duprin, Inc.; an Ingersoll-Rand Company (VD).
    b. Approved equal.

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 Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

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.

D. Dustproof Strikes: BHMA Grade 1.

2.8 OPERATING TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: See Hardware Schedule on drawings.

B. Standard: Comply with BHMA A156.6.

C. Push-Pull Design: As illustrated on Drawings.

2.9 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Surface-Mounted Closers:

    a. LCN Closers; an Ingersoll-Rand Company (LCN).
    b. Hager.
    c. Approved equal.

2. Concealed Closers:

    a. LCN Closers; an Ingersoll-Rand Company (LCN).
    b. Hager.
    c. Approved equal.

3. Closer Holder Release Devices:

a. LCN Closers; an Ingersoll-Rand Company (LCN).
b. Hager.
c. Approved equal.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.
2. Closer Holder Release Devices: BHMA A156.15.
3. Approved equal.

C. Surface Closers: BHMA Grade 1.

D. Concealed Closers: BHMA Grade 1.

E. Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."

F. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.

G. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

H. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers, unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

I. Power-Assist Closers: As specified in Division 8 Section "Power Door Operators" for access doors for the disabled or where listed in the Door Hardware Schedule. Provide electrohydraulic, electromechanical, and pneumatic types as indicated.

J. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.10 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. See Hardware Schedule on Drawings.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:

1. Aluminum: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.
2. Stainless Steel: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in Door Hardware Schedule.

2.11 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
2. Hager.
3. Approved equal.

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. Stops and Bumpers: BHMA Grade 1.

D. Mechanical Door Holders: BHMA Grade 1.

E. Electromagnetic Door Holders for Labeled Fire Door Assemblies: Coordinate with fire detectors and interface with fire alarm system.

F. 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.

G. 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.

2.12 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Door Gasketing:

a. Pemko Manufacturing Co., Inc. (PEM).
b. National Guard Products, Inc. (NGP).
c. Hager.
d. Approved equal.

2. Door Bottoms:

a. National Guard Products, Inc. (NGP).
b. Hager.
c. Approved equal.

B. Standard: Comply with BHMA A156.22.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

I. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.13 THRESHOLDS

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. National Guard Products, Inc. (NGP).
2. Hager.
3. Approved equal.

C. Standard: Comply with BHMA A156.21.

2.14 MISCELLANEOUS DOOR HARDWARE

A. Standard: Comply with the following:

1. Auxiliary Hardware: BHMA A156.16.

B. Auxiliary Hardware: BHMA Grade 1, unless otherwise indicated.

C. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

2.15 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."

2.16 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.

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. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. 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. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.
2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

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.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

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

GROUP 1

1.5 PAIR	BUTTS	BB5006 4.5 X 4.5	26DBOMMER
1 EACH	EXIT	98L X IC BEST CYL	26DVON DUPRIN
1 EACH	CLOSER	P4041 SPRING CUSH	LCN
1 EACH	KICKPLATE	10" X 2" LDW	32DQUALITY
1 EACH	THRESHOLD	425	NG
1 EACH	WEATHERSTRIP	160	NG
1 EACH	SWEEP	200	NG

GROUP 2

1.5 PAIR	BUTTS	BB5002 4.5 X 4.5	26DBOMMER
1 EACH	LOCKSET	93K7 AB 15C	626 BEST
1 EACH	CLOSER	P4041 SPRING CUSH	LCN
1 EACH	KICKPLATE	10" X 2" LDW	32DQUALITY
1 EACH	THRESHOLD	425	NG
1 EACH	WEATHERSTRIP	160	NG
1 EACH	SWEEP	200	NG

GROUP 3

1.5 PAIR	BUTTS	BB5000 4.5 X 4.5	26DQUALITY
1 EACH	LOCKSET	93K7 AB 15C	626 BEST
1 EACH	STOP	302	26DQUALITY

GROUP 4

3 PAIR	BUTTS	BB5001 4.5 X 4.5	26DQUALITY
1 EACH	LOCKSET	93K7 D 15C	26DBEST
2 EACH	FLUSH BOLT	1358 12"	26DQUALITY
2 EACH	CLOSER	P4041 EDA H	LCN
2 EACH	STOP	307	26DQUALITY
1 EACH	THRESHOLD	425	NG
1 EACH	WEATHERSTRIP	160	NG
1 EACH	SWEEP	200	NG

GROUP 5

1.5 PAIR	BUTTS	BB5000 4.5 X 4.5	26DBOMMER
1 EACH	PUSH	40 3.5 X 15	26DQUALITY
1 EACH	PULL	1510 3.5 X 15	26DQUALITY
1 EACH	CLOSER	4041	LCN
1 EACH	KICKPLATE	10" X 2" LDW	32DQUALITY
1 EACH	STOP	307	26DQUALITY

GROUP 6

1.5 PAIR	BUTTS	BB5000 4.5 X 4.5	26DBOMMER
1 EACH	PRIVACY	93K0 L 15C	26DBEST
1 EACH	CLOSER	4041	LCN
1 EACH	KICKPLATE	10" X 2" LDW	32DQUALITY
1 EACH	STOP	302	26DQUALITY

GROUP 7

1.5 PAIR	BUTTS	BB5000 4.5 X 4.5	26DBOMMER
1 EACH	LOCKSET	93K7 D 15C	26DBEST
1 EACH	CLOSER	P4041 EDA	LCN
1 EACH	STOP	307	26DQUALITY
1 EACH	SMOKE SEAL	2525	NG

GROUP 8

1.5 PAIR	SPRING HINGE	3029-6	26DBOMMER
2 EACH	PUSH	40 3.5 X 15	26DQUALITY
2 EACH	ARMOUR PLATE	40" X 2" LDW	32DQUALITY
2 EACH	STOP	331 ED	26DQUALITY

END OF SECTION 08711

SECTION 08800 - GLAZING

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 glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Steel Windows.
2. Sitle and Rail Wood Doors.

1.3 DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

1. Minimum glass thickness, nominally, of lites in exterior walls is 6 mm.
2. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:

   a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

b. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind or snow.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 F deg (67 C deg), ambient; 180 F deg (100 C deg), material surfaces.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each glass product and glazing material indicated.

C. Samples for verification purposes of 12-inch (300 mm) square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch (300 mm) long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.

D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

E. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 1.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."
2. LSGA Publications: "LSGA Design Guide."
3. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."

B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

D. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:

1. Primary glass of each (ASTM C 1036) type and class indicated.
2. Heat-treated glass of each (ASTM C 1048) condition indicated.
3. Insulating glass of each construction indicated.
4. Insulating, obscure glass as selected and approved by architect.

E. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4 deg C).

1.9 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion. (for glass, and against leakage through caulking or gaskets).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include products listed in this section.

2.2 PRIMARY FLOAT GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).

1. Class 1 (clear) unless otherwise indicated.

B. Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

C. Patterned Glass: ASTM C 1036, Type II (patterned flat glass), Class 1 (clear), Form 3, Obscure glass; and of quality, finish, and pattern specified.

2.3 HEAT-TREATED FLOAT GLASS

A. Uncoated, Clear, Heat-Treated Float Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.

1. Kind FT (fully tempered) where indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heat-treated glass products that may be incorporated in the Work include, but are not limited to, the following companies.

1. AFG Industries, Inc.
2. Artistic Glass Products Co.
3. Cardinal IG.
4. Saint-Gobain.
5. Falconer Glass Industries.
6. Glasstemp, Inc.
7. Guardian Industries Corp.
8. HGP Industries.
9. PPG Industries, Inc.
10. Spectrum Glass Products, Inc.
11. Tempglass.

12. Viracon, Inc.
13. Capitol Glass

2.4 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
3. Colors: Provide color of exposed joint sealants to comply with the following:

   a. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements indicated on each Elastomeric Glazing Sealant Product Data Sheet at the end of this Section, including those referencing ASTM classifications for Type, Grade, Class and Uses.

1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Glazing Sealant Product Data Sheet, provide products, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, with the capability to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistive rating.

2.6 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

2.7 MONOLITHIC FLOAT-GLASS UNITS

A. Glass Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, 6.0 mm thick.

2.8 MONOLITHIC PATTERNED-GLASS UNITS

B. Patterned-Glass Units: Annealed, Quality-Q 5, Low-E, Finish F 1 (patterned one side), Pattern P 2 (geometric) , 6.0 mm thick.

1. Available Products:

a. AFG Industries Inc.; Krystal Flutes.
b. Pilkington Building Products North America; Matrix.
c. AFG Industries Inc.; Aquatex.
d. Guardian Industries Corp.; Privata.
e. Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (1250 mm) (length plus height) as follows:

1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08800

SECTION 09230 - GYPSUM PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gypsum plasterwork on existing plaster interior wall finish.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Mockups: Before plastering, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following applications:

a. Troweled Finishes: Surfaces indicated to receive paint finishes.
b. Surfaces with float finish to match existing.

2. Simulate finished lighting conditions for review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. 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.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.

B. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.

C. Avoid conditions that result in gypsum plaster drying out too quickly.

1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. General: Comply with ASTM C 841 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories: (Select from the following as required to match existing)

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

a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
b. CEMCO.
c. Clark Western Building Systems.
d. Dietrich Metal Framing; a Worthington Industries company.
e. MarinoWARE.
f. Phillips Manufacturing Co.

2. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
3. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.

a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
b. Small nose cornerbead with perforated flanges; use on curved corners.
c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
d. Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.

5. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

6. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
8. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.

2.2 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Washed sand as required to match existing texture.

C. Bonding Compound: ASTM C 631.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 841.

F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.

G. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 BASE-COAT PLASTER MATERIALS

A. Base-Coat Plasters, General: ASTM C 28/C 28M.

B. High-Strength Gypsum Neat Plaster: With a minimum, average, dry compressive strength of 2800 psi (19 MPa) per ASTM C 472 for a mix of 100 lb (45 kg) of plaster and 2 cu. ft. (0.06 cu. m) of sand.

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

a. USG Corporation; Structo-Base.
b. Approved equal.

C. Aggregates for Base-Coat Plasters: ASTM C 35, sand.

2.4 FINISH-COAT PLASTER MATERIALS

A. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M, with a minimum, average, dry compressive strength of 5000 psi (34 MPa) per ASTM C 472 for a neat mix.

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

a. USG Corporation; Structo-Gauge.
b. Approved equal.

B. Aggregates for Float Finishes: ASTM C 35, sand; graded per ASTM C 842.

2.5 PLASTER MIXES

A. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine nonstructural and structural metal framing, substrates, and hollow-metal frames, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

3.3 INSTALLATION, GENERAL

A. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING ACCESSORIES (Select from the following as required to match existing)

A. General: Install according to ASTM C 841.

B. Cornerbeads: Install at external corners.

C. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.

D. Control Joints: Install control joints at locations where control joints are existing.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 842.

1. Do not deviate more than plus or minus 1/8 inch in 10 feet (3.1 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on existing plaster bases where required.

C. Base Coats, where required for patching existing plaster:

1. Base Coats: High-strength gypsum plaster with job-mixed sand for scratch and brown coats over Unit Masonry.

D. Finish Coats:

1. Finish-Coat Mix for Smooth-Troweled Finishes to match existing: High-strength gypsum gaging plaster.

E. Plaster Finishes:

1. Provide troweled sanded finish as required to match existing.

3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09230

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. Non-load-bearing steel framing.
3. Tile backing panels.

B. Related Sections include the following:

1. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in gypsum board assemblies.

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."

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.

1.6 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. National Gypsum Company.
e. Scafco Corporation.
f. Unimast, Inc.
g. Western Metal Lath & Steel Framing Systems.

2. Gypsum Board and Related Products:

a. American Gypsum Co.
b. G-P Gypsum Corp.
c. National Gypsum Company.
d. United States Gypsum Co.

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- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

C. Hanger Attachments to Concrete: As follows:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 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 (4.12-mm) diameter.
2. Rod Hangers: ASTM A 510 (ASTM A 510M), mild carbon steel.

3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

1. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base Metal Thickness: As indicated.
b. Depth: As indicated

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm) .

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 ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

B. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 24 gague.
2. Depth: 3 5/8 inch, 6 inch, or as indicated.

C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 26 gague.
2. Depth: 7/8 inch.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base Metal Thickness: 0.027 inch (0.7 mm), or as indicated.

F. 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. Type X:

a. Thickness: 5/8 inch.
b. Long Edges: Tapered.

2.5 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. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.

1. Core: 1/2 inch (12.7 mm), regular type.

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 (12.7 mm) no,inal.

2.6 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. Cornerbead: Use at outside corners.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
    c. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.
    d. Expansion (Control) Joint: Use where indicated.

B. 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.

2.7 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 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 drying-type, all-purpose compound.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.8 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 (0.84 to 2.84 mm) 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 (3.2 mm) 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."

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.

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 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 (3 mm in 3.6 m) measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.

E. 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 (3 mm) 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 (13 mm) 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 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 and furring at the following spacings:

1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
2. Cementitious Backer Units: 16 inches (406 mm) o.c., unless otherwise indicated.

E. 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.

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 (13-mm) 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.

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 (1.5 mm) 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) 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- (6.4- to 12.7-mm-) 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, 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 (304.8 mm) o.c. for vertical applications.

O. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) 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 vertically (parallel 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. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. 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.

D. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
2. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
3. 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.
4. 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 according to ASTM C 840 and in specific locations approved by Architect for visual effect.

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 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.
2. 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.

3.10 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.

END OF SECTION 09260

SECTION 09310 - CERAMIC TILE

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. Un-glazed ceramic mosaic floor tile.
2. Glazed wall tile.
3. Quarry tile.
4. Crack-suppression membrane for thin-set tile installations.
5. Cementitious backer units installed as part of tile installations.
6. Metal edge strips installed as part of tile installations.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for removing existing finishes.
2. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
3. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
4. Division 9 Section "Gypsum Board Assemblies" for water-resistant backer board.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

1.5 SUBMITTALS

A. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
3. Metal edge strips in 6-inch (150-mm) lengths.

B. Product Certificates: For each type of product, signed by product manufacturer.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish, from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

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. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Available]Manufacturers:

1. American Olean; Div. of Dal-Tile International Corp.
2. Crossville Ceramics Company, L.P.
3. Daltile; Div. of Dal-Tile International Inc.
4. Summitville Tiles, Inc.

B. Unglazed Ceramic Mosaic Tile: Factory-mounted flat tile as follows:

1. Composition: Impervious natural clay or porcelain.
2. Surface: Smooth, without abrasive admixture.
3. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
4. Nominal Thickness: 1/4 inch (6.35 mm).
5. Face: Pattern of design indicated, with cushion edges.
6. Basis-of-Design Product: 90% Price Group 1 for field, 10% price group 2 for accent.

C. Glazed Wall Tile : Flat tile as follows:

1. Module Size: 4 1/4 by 4 1/4 inches (108 by 108 mm), unless otherwise indicated.
2. Thickness: 5/16 inch (8 mm).
3. Face: Plain with modified square edges or cushion edges.
4. Finish: Bright, opaque.
5. Mounting: Factory back-mounted.
6. Basis-of-Design Product: Field Color Price Group 1 Accent Colors Price Group 2.

D. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).
2. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).
3. External Corners for Thin-Set Mortar Installations: Surface bullnose.
4. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.
5. Sill and jamb trim to match Building 5100.

E. Unglazed Quarry Tile : Square-edged flat tile as follows:

1. Wearing Surface: Nonabrasive, smooth.
2. Facial Dimensions: 6 by 6 inches (152 by 152 mm), or 8 by 8 inches (203 by 203 mm).
3. Thickness: 1/2 inch (12.7 mm).
4. Face: Plain.
5. For furan-grouted quarry tile, precoat with temporary protective coating.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.

B. Marble Thresholds, where indicated: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

C. Vinyl Reducer Strip, where indicated, by Section 09651 – RESILIANT TILE FLOORING.

2.5 SETTING AND GROUTING MATERIALS

A. Manufacturers:

1. Bostik.
2. LATICRETE International Inc.
3. MAPEI Corporation.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
2. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.

a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

C. Organic Adhesive: ANSI A136.1, Type I.

D. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

E. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.

F. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.

1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.
   a. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products:

a. Dow Corning Corporation; Dow Corning 786.

b. Tremco, Inc.; Tremsil 600 White.

D. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout. Include primer and backer rod recommended by manufacturer.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, nickel silver exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

1. Products:
   a. Bostik; CeramaSeal Grout Sealer.
   b. C-Cure; Penetrating Sealer 978.
   c. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
   d. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

E. Provide sealer for Grout.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.Delete below if not applicable or if cementitious backer units are specified in Division 9 Section "Gypsum Veneer Plaster" or "Gypsum Board Assemblies."

3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).

C. Stone (or Vinyl) Thresholds: Install thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

E. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

C. Joint Widths: Install tile on walls with the following joint widths:
   1. Glazed Wall Tile: 1/16 inch (1.6 mm).

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 FLOOR TILE INSTALLATION SCHEDULE

A. Tile Installation : Interior floor installation on concrete; cement mortar bed (thinset) bonded to concrete; ANSI A118.4.

   1. Tile Type: Unglazed ceramic mosaic tile.
   2. Grout: Standard sanded cement.

3.8 WALL TILE INSTALLATION SCHEDULE

A. Tile Installation : Where indicated, interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.

1. Tile Type: Glazed wall tile .
2. Thin-Set Mortar: Latex- portland cement mortar.
3. Grout: Standard unsanded cement grout.

B. Tile Installation : Interior wall installation over water-resistant gypsum board or cement-backer board, where indicated, thin-set mortar; TCA B413, TCA W243, and ANSI A108.5.

1. Tile Type: Glazed wall.
2. Thin-Set Mortar: Latex- portland cement mortar.
3. Grout: Standard unsanded cement grout.

END OF SECTION 09310

SECTION 09511 - ACOUSTICAL PANEL 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 panels and exposed suspension systems for ceilings.

B. 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. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

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

B. Coordinate Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension 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. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).

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 Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

E. Qualification Data: For testing agency.

F. Field quality-control test reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

H. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.

I. 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 Panel: 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 panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel 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 panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

   a. Smoke-Developed Index: 450 or less.

E. Seismic Standard: Provide acoustical panel 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 Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

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 panels, 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 panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel 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 panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels 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 Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of amount 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. Basis of Design: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels 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 Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels 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. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

D. Humidity resistant to inhibit panel sag.

2.3 WET FORMED MINERAL-FIBER BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Basis of Design:

1. Armstrong, Dune, Square Lay-in, 24" X 48"X 5/8", unless otherwise scheduled on Drawings.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2.
2. Pattern: C (perforated, small holes) E (lightly textured).

C. Color: White .

D. NRC: Not less than 0.50.

E. CAC: Not less than 30.

F. Edge Detail: Square.

G. Thickness: 5/8 inch (15 mm).

H. Size: 24 by 48 inches (610 by 1220 mm).

I. Antimicrobial Treatment: Coating based.

2.4 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS WITH MEMBRANE-FACED OVERLAY

A. Basis of Design Products:

1. Armstrong, Ceramaguard, Non-perforated.

B. Classification: Provide panels complying with ASTM E 1264 for Type XX, ceramic and mineral fiber composite with vinyl membrane-faced overlay; Form 2, water felted.

1. Overlay: Vinyl overlay on face.
2. Pattern: G (smooth).

C. Color: White.

D. LR: Not less than 0.88.

E. NRC: Not less than 0.10.

F. CAC: Not less than 40.

G. Edge Detail: Square, lay-in.

H. Thickness: 5/8 inch (15 mm).

I. Size: 24 by 48 inches (610 by 1220 mm).

J. Antimicrobial Treatment: Coating based.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung 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: Postinstalled expansion anchors.
   b. Type: Postinstalled adhesive anchors.
   c. 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.
   d. 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 anchor.
   e. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

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.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Basis of Design:

1. Armstrong, 15/16" Prelude.

B. Wide-Face, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Finish: Painted white.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Basis of Design Manufacturers:

1. Armstrong World Industries, 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 panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

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, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

2.8 ACOUSTICAL SEALANT

A. Available Products:

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. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
    b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
    c. Pecora Corp.; BA-98.
    d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing 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: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel 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 panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with IBC 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 ceiling area and where necessary to conceal edges of acoustical panels.

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. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.
   b. Install panels with pattern running in one direction parallel to long axis of space.
   c. Install panels with pattern running in one direction parallel to short axis of space.
   d. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: 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 installations of acoustical panel ceiling hangers shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

C. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

1. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Remove and replace acoustical panel ceiling hangers where test results indicate that they do 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.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09651 – VINYL COMPOSITION TILE

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. Vinyl composition tile (VCT).

B. Related Sections include the following:

1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tile.

1.3 SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 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 for 48 hours after floor covering installation.

D. Install resilient products after other finishing operations, including painting, have been completed.

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 Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.2 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.
1. Armstrong World Industries, Inc.;
2. Azrock Commercial Flooring, DOMCO;
3. Congoleum Corporation;
4. Mannington Mills, Inc.;

B. Class: 2 (through-pattern tile).

C. Wearing Surface: Smooth

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.3 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.

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 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

F. 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.

G. 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.

3.3 TILE 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 basket-weave pattern or 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 with grain direction alternating in adjacent tiles (basket-weave pattern).

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.

3.4 CLEANING AND PROTECTION

A. 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.

B. 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.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

   a. Use commercially available product acceptable to manufacturer.
   b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09651

SECTION 09653 - RESILIENT WALL BASE AND 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. Resilient wall base.
2. Resilient floor accessories.

1.3 SUBMITTALS

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

B. Samples for Verification: In manufacturer's standard sizes, but not less than 12 inches (300 mm) long, of each product color and pattern specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
2. Deliver extra materials to Owner.

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:
   a. Roppe Rubber Wall Base
   b. Armsrong Rubber Wall Base
   c. Flexco Rubber Wall Base
   d. Johnsonite Rubber Wall Base

2.2 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I.

2.3 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements shown on the drawings.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

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, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
5. Install premolded outside and inside corners before installing straight pieces.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other 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 resilient product manufacturer.

1. Apply protective floor polish to vinyl resilient products installed on floors and stairs that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.

a. Use commercially available product acceptable to resilient product manufacturer.
b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover resilient products installed on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.

C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

1. Before cleaning, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.
2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

Camp W. G. Williams
Building 5080
DFCM #07332480

END OF SECTION 09653

SECTION 09900 - PAINTING

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 the following:

1. Exposed exterior items and surfaces.
2. Exterior portland cement (stucco).
3. Exposed interior items and surfaces.
4. 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 the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the 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 work, and primed metal surfaces of mechanical and electrical equipment.

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 and casework.
b. Acoustical wall panels.
c. Metal toilet enclosures.
d. Metal lockers.
e. Food Service Equipment.
f. Finished mechanical and electrical equipment including grilles and diffusers.
g. Light fixtures.
h. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.

c. Ceiling plenums.
d. Pipe spaces.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper.
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 Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.
4. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

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 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until 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.

C. Qualification Data: For firms and persons specified in the "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.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

   a. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m) of wall surface.
   b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

   a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the 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 (7 deg C). Maintain containers used in storage 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. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) 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 in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

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 the paint schedules.

B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

1. Benjamin Moore & Co. (Moore).
2. Pratt & Lambert, Inc. (P & L).
3. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and 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. 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: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the 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 the Architect about anticipated problems 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 the 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 the substrates of substances that could impair the 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 masonry block, 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 where moisture content exceeds that permitted in manufacturer's written instructions.

3. 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 the Steel Structures Painting Council's (SSPC) recommendations.

   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. 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 the same primer as the shop coat.

D. Materials 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 the same material are applied. Tint undercoats to match the color of the finish

coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 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 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, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the 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 the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on 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 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, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the 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 the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Heat exchangers.
3. Ductwork.
4. Insulation.
5. Motors and mechanical equipment.
6. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.

H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the 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.

I. 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.

J. 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.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Low-Luster Acrylic Finish: 2 finish coats over a rust-inhibitive primer.

a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
2) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.

b. First and Second Coat: Low-sheen (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
1) Moore: MoorGard Latex House Paint #103.
2) P & L: Z/F 4200 Series Accolade Exterior Eggshell.

B. Galvanized-Metal Substrates:

1. Alkyd System: MPI EXT 5.3B.

a. Prime Coat: Cementitious galvanized-metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).

C. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:

1. High-Build Latex System: MPI EXT 9.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: High-build latex (exterior).

D. Wood Panel Substrates: Including wood fascias and soffits.

1. Alkyd System: MPI EXT 6.4B.

   a. Prime Coat: Exterior alkyd wood primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel (semigloss).

E. Dressed Lumber Substrates: Including wood doors.

1. Alkyd System: MPI EXT 6.3B.

   a. Prime Coat: Exterior alkyd wood primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel (semigloss).

3.7 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
      1) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
      2) P & L: Z/F 1001 Suprime "1" 100 Percent Acrylic Multi-Purpose Primer.

   b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
      1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.
      2) P & L: Z/F 4100 Series Accolade Interior Semi-Gloss.

B. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Semigloss Alkyd-Enamel Finish: Two finish coats over a primer.

   a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
   b. Finish Coats: Interior semigloss alkyd enamel.

C. Existing Wood and Hardboard: Provide the following paint finish systems over existing interior wood surfaces:

1. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.

   a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.

b. Finish Coats: Interior semigloss alkyd enamel.

D. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
2) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
1) Moore: Moore's Regal AquaVelvet #319.
2) P & L: Z/F 4000 Series Accolade Interior Velvet.

E. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. 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 (0.076 mm).
3. Sherwin-Williams; Galvite HS B50WZ30: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

F. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.

END OF SECTION 09900

SECTION 09960 - HIGH-PERFORMANCE COATINGS

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 application of high-performance coating systems to items and surfaces scheduled.

B. Related Sections include the following:

1. Division 9 Section "Painting" for general field painting.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:

1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

C. Environments: The following terms are used in Part 2 of this Section to distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.
2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.
3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.4 SUBMITTALS

A. Product Data: For each coating system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the 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 material specified.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

D. 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. List of material and application 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:

a. Concrete: Provide two 4-inch- (100-mm-) square samples for each color and finish.
b. Concrete Masonry: Provide two 8-inch- (200-mm-) square samples of masonry, with mortar joint in the center, for each finish and color.

E. 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.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of 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, area, or surface to represent surfaces and conditions for application of each type of coating and substrate.
   a. Small Areas and Items: Architect will designate items or areas required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface as specified. Provide the required sheen, color, and texture of 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 with the following information:

1. 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. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish extra coating materials in quantities indicated below:
   a. High-Gloss, Polyamide Epoxy Coatings: 5 percent but not less than 1 gal. (3.785 L) or 1 case, as appropriate of each color applied.
   b. Semigloss, Polyamide Epoxy Coatings: 5 percent but not less than 1 gal. (3.785 L) or 1 case, as appropriate of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.

B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:

1. Carboline Company (Carboline).
2. DuPont Company, High Performance Coatings (DuPont).
3. ICI Dulux Paints; Devoe Coatings (ICI).
4. International Protective Coatings; Courtaulds Coatings (International).
5. Moore: Benjamin Moore & Co. (Moore).
6. Pittsburgh Paint; PPG Industries, Inc. (PPG).
7. Rust-Oleum Corporation (R-O).
8. Sherwin Williams; Industrial and Marine Coatings (S-W).
9. Tnemec Company, Inc. (Tnemec).

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not 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. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

2.3 COLORS

A. Colors: As selected by Architect from manufacturer's full range.

2.4 INTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Interior Gypsum Board Toilet Room and Kitchen Walls:

1. Moderate Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Acrylic or epoxy primer, as recommended by manufacturer for this substrate, applied at spreading rate recommended by manufacturer.

1) Carboline: Multi-Bond 120 Waterborne Acrylic Primer.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Tru-Glaze-WB 4406 Waterborne Epoxy Semigloss Coating (128XX).
4) International: Intergard 475 Semi-Gloss Polyamide Epoxy Intermediate/Finish thinned 15 percent.
5) R-O: 9500 System High Build Polyamide Epoxy.
6) S-W: Heavy Duty Epoxy B67W300 Series/B60V3.
7) Tnemec: Series 151 Elasto-Grip Waterborne Polyamide Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 6.0 mils (0.038 to 0.152 mm).

1) Carboline: Sanitile 250 WB Finish Waterborne Epoxy-Acrylic.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Tru-Glaze-WB 4406 Waterborne Epoxy Semigloss Coating (128XX).
4) International: Intergard 475 Semi-Gloss Polyamide Epoxy Intermediate/Finish.
5) R-O: Intermediate coat not required.
6) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
7) Tnemec: Series 29 Tuf-Cryl Water Based Acrylic Emulsion.

c. Topcoat: Semigloss Epoxy-acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 6.0 mils (0.051 to 0.152 mm), unless otherwise indicated.

1) Carboline: Sanitile 250 WB Finish Waterborne Epoxy-Acrylic.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Tru-Glaze-WB 4406 Waterborne Epoxy Semigloss Coating (128XX).
4) International: Intergard 475 Semi-Gloss Polyamide Epoxy Intermediate/Finish.
5) R-O: 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.

6) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
7) Tnemec: Series 29 Tuf-Cryl Water Based Acrylic Emulsion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.
b. Confirmation of primer's ability to be top coated with materials specified.

2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.

a. 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 coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, 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.

a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.

a. Omit primer on metal surfaces that have been shop primed and touchup painted.
b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention

to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.

   a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
   b. Brush out and work brush coats into surfaces in an even film.
   c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.

   a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
   b. Apply each coat to provide the equivalent hiding of brush-applied coats.
   c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:

1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:

a. Quantitative materials analysis.
b. Absorption.
c. Accelerated weathering.
d. Accelerated yellowness.
e. Color retention.
f. Alkali and mildew resistance.
g. Abrasion resistance.
h. Apparent reflectivity.
i. Washability.
j. Dry opacity.
k. Recoating.
l. Skinning.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.5 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 09960

SECTION 10155 - TOILET COMPARTMENTS

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 baked-enamel units as follows:

1. Toilet Enclosures: Overhead braced.
2. Urinal Screens: Wall hung.

B. Related Sections include the following:

1. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

D. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation 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 units without field

measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

2.2 METAL UNITS

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, or an approved equal:

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. Metpar Corp.
11. Sanymetal; a Crane Plumbing Company.
12. Weis-Robart Partitions, Inc.

C. 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.

1. Facing Sheet Thicknesses: Minimum base-metal (uncoated) thicknesses as follows:

a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.0329 inch (0.85 mm).
b. Panels: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).
c. Doors: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).
d. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).
e. Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0329 inch (0.85 mm).

2. Finish: Manufacturer's standard pigmented, organic coating, including thermosetting, electrostatically applied, and powder coatings. Provide coating system that complies with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.

   a. Color: One color in each room as selected by Architect from manufacturer's full range of colors.

D. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

   1. For solid-plastic, polymer-resin pilasters, in lieu of stainless-steel pilaster shoes and sleeves, manufacturer's standard plastic pilaster shoes and sleeves may be provided.

E. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:

   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

F. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

   1. Material: Clear-anodized aluminum.

G. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:

   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

H. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

I. 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.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

   1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Overhead-Braced-and-Floor-Anchored Compartments: 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.

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 handicapped accessible.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
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 bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10155

SECTION 10265 - IMPACT-RESISTANT WALL PROTECTION

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. Impact and moisture-resistant fiber reinforced plastic wall coverings.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for metal angle corner guards.
2. Division 8 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Maintenance Data: For each impact and moisture-resistant wall-protection unit to include in maintenance manuals.

1. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact and moisture-resistant wall-protection panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

E. Fire-Test-Response Characteristics: Provide impact and moisture-resistant, plastic wall-protection panels with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact and moisture-resistant wall-protection panels in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
   a. Store wall panels in a horizontal position.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures.
   b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five 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. 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.

2.2 MATERIALS

A. Plastic Sheet Wall Covering Material: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, semirigid, high-impact-resistant PVC or acrylic-modified vinyl plastic sheet with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

1. Use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Gypsum Board and Panel Adhesives: 50 g/L.
b. Multipurpose Construction Adhesives: 70 g/L.
c. Contact Adhesive: 250 g/L.

2.3 IMPACT-RESISTANT WALL COVERINGS

A. Semirigid, Impact and Moisture-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall covering material.
1. Available Manufacturers:

a. American Floor Products Co., Inc.
b. ARDEN Architectural Specialties, Inc.
c. Balco, Inc.
d. Construction Specialties, Inc.
e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
f. Korogard Wall Protection Systems; Division of RJF International Corporation.
g. Pawling Corporation.
h. Approved equal.

2. Size: 48 by 96 inches (1219 by 2438 mm) for sheet or As indicated.
3. Sheet Thickness: 0.125 inch (3.0 mm).
4. Color and Texture: As selected by Architect from manufacturer's full range.
5. Height: Wainscot, height as indicated.
6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
7. Mounting: Adhesive.

2.4 FABRICATION

A. Fabricate impact and moisture-resistant wall panels to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. 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. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine walls to which impact and moisture-resistant wall panels will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
2. For impact and moisture-resistant wall-protection units attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact and moisture-resistant wall panels level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact and moisture-resistant wall panels in locations and at mounting heights indicated on.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Adjust corner, top and base caps as required to ensure tight seams.

B. Impact and Moisture-Resistant Wall Covering: Provide top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10265

SECTION 10426 – INTERIOR PANEL SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 1 Specification Sections, the General and Supplemental Conditions, and Project Drawings apply to this section.

1.2 SUMMARY OF WORK

A. This section includes the following types of panel signs:

1. ADA compliant, laminated panel signs.

1.3 SUBMITTALS

A. Product data for each material relative to tactile copy, face laminate, backing sheets, and lamination adhesives.

C. Shop drawings showing fabrication and erection of signs. Include large scale plans, elevations, and sections showing construction and layout of typical components.

1. Provide message list for each sign required, including large scale details of lettering and Braille layout.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern, surface texture and demonstration of compliance with product requirements.

1. Tactile appliqué laminate: Manufacturer's color charts consisting of actual sections of material demonstrating the full range of colors available.
2. Face laminate: 4"x4" sections of clear material demonstrating non glare surface.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

Manufacturers: Subject to compliance with the requirements, provide products from one of the following:

1. Manufactures of panel signs:
    a. ABC Architectural Sign Systems
    b. ASI Sign Systems, Inc.
    c. Best Manufacturing
    d. Environmental Graphic Systems, Inc.
    e. Modulex.
    f. The Super Sign Company.

2.2 MATERIALS

A. Tactile appliqué: Opaque, single ply, modified acrylic sheet not less than 1/32" in thickness.
B. Face laminate: Clear, non glare, cast acrylic sheet or matte finish impact acrylic engraving stock not less than 1/16" in thickness.
C. Backing sheet: Expanded PVC sign board not less than 1/8" (3mm) in thickness. 'Sintra' manufactured by Alusuisse Composites, Inc., and 'Versacel' manufactured by HPG International, Inc., are acceptable products. Product of other manufactures exhibiting equal physical properties may be substituted. Provide color directed by the Architect.

2.3 LAMINATED PANEL SIGNS

A. Comply with requirement indicated for materials, thickness, finish, color, design, shape, size, and detail of construction.

1. Tactile text shall be .75 inch in height and shall be located at the top left side of the sign. A margin of .75 inch shall be maintained between copy and the sign edges. Characters shall be machine cut to provide uniform smooth beveled edges and shall be permanently bonded to the face material using specially formulated adhesive or chemical welding. Graphic content shall comply with ADA requirements for size, style, spacing, content, position, material, finish, and color contrast
2. ADA Grade 2 Braille shall be provided on each sign, and shall be located .375 inch below and left justified with tactile text. Braille shall be the applied Raster method.
3. Size. Non insert signs shall be 10" wide and 7" high.
4. Face laminations shall be 1/16", single ply, clear cast acrylic, or impact acrylic with a matte or non glare finish. Each face lamination shall be back sprayed with an opaque colored coating compatible with the material. Color shall be as selected by the Architect. Application to spacer and backer sheets shall utilize 100% adhesive coverage within each lamination.
5. Edges condition. Square cut. Provide edge finishing after fabrication producing a smooth even surface across the laminations.
6. Corner condition. Provide .5" radius corners produced after lamination.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install sign units as indicated or directed by the Architect. Use methods of the type described and in accordance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Wall mounted signs.
    a. Attach to non porous surfaces or sealed masonry using double sided foam tape equal to 3M 'VHB' High Performance Series.
    b. Use silicone adhesive recommended by the sign manufacturer for

installation on irregular surfaces, unsealed masonry, or vinyl covered surfaces. Use double sided tape to hold signs in place until adhesive is fully cured.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect from damage until acceptance by the Owner.

END OF SECTION 10426

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. Fire extinguishers, Cabinets, and wall mount brackets.

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 and Cabinets: Include classification.

B. 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.

1.5 COORDINATION

A. Coordinate locations of fire extinguishers and brackets and provide solid blocking in stud walls for anchoring.

1.6 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. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. Ansul Incorporated.
2. Badger Fire Protection.
3. Buckeye Fire Equipment Company.
4. General Fire Extinguisher Corporation.
5. JL Industries, Inc.
6. Modern Metal Products; Div. of Technico.
7. Moon American.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and bracket 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 and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

C. Multipurpose Dry-Chemical Type in Steel Container: 3-A:40-B:C, 6-lb (2.7-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

D. Accessories:

1. Metal wall mount bracket: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cylinder lock, keyed alike to other cabinets.
4. 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 door.

2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Black.
4) Orientation: Horizontal.

E. Finishes:

1. Steel: Baked enamel.

2.2 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.
2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.

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 (13 mm) thick.
2. Miter and weld perimeter door frames.

2.3 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.

2.4 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. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. 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 (0.05 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and 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 recessed and 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: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide surface mounted 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.

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. Toilet and bath accessories.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for blocking and backing for accessories in stud wall construction.

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. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

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

1. Toilet and Bath Accessories:

a. American Accessories, Inc.
b. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

C. 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.

G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

H. 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: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on 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 (0.85 mm) 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.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

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 (1112 N), 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 ACCESSORY SCHEDULE

A. Refer to Accessory Schedule on Drawings.

END OF SECTION 10801

SECTION 13915 - FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Automatic wet-type, Class II standpipe systems.
2. Wet-pipe sprinkler systems.

1.2 SYSTEM DESCRIPTIONS

A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.

B. Automatic Wet-Type, Class II Standpipe System: Includes NPS 1-1/2 hose stations. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

C. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.3 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.

1. Minimum Residual Pressure at Each Hose-Connection Outlet: 65 psig.
2. Unless Otherwise Indicated, the Following Is Maximum Residual Pressure at Required Flow at Each Hose-Connection Outlet: 100 psig.

C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 1.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.

e. Office and Public Areas: Light Hazard.
f. Restaurant Service Areas: Ordinary Hazard, Group 1.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm/sq.ft. over 1500 sq. ft. .
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq.ft. over 1500 sq. ft..

4. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft.
b. Storage Areas: 130 sq. ft.
c. Mechanical Equipment Rooms: 130 sq. ft.
d. Electrical Equipment Rooms: 130 sq. ft.
e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.4 SUBMITTALS

A. Product Data: For each product indicated.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

C. Field test reports and certificates.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
4. NFPA 230, "Fire Protection of Storage."

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

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Available Manufacturers:

1) Victaulic Co. of America.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
d. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Available Manufacturers:

1) Anvil International, Inc.
2) Central Sprinkler Corp.
3) Ductilic, Inc.
4) JDH Pacific, Inc.
5) National Fittings, Inc.
6) Shurjoint Piping Products, Inc.
7) Southwestern Pipe, Inc.
8) Star Pipe Products; Star Fittings Div.
9) Victaulic Co. of America.
10) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Available Manufacturers:

1. Anamet Inc.
2. Flex-Hose Co., Inc.
3. Flexicraft Industries.
4. Flex-Pression, Ltd.
5. Flex-Weld, Inc.
6. Hyspan Precision Products, Inc.
7. Mercer Rubber Co.
8. Metraflex, Inc.
9. Proco Products, Inc.
10. Unaflex Inc.

C. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings:

1. Available Manufacturers:

a. Anvil International, Inc.
b. Central Sprinkler Corp.
c. Ductilic, Inc.
d. JDH Pacific, Inc.
e. National Fittings, Inc.
f. Shurjoint Piping Products, Inc.
g. Southwestern Pipe, Inc.
h. Star Pipe Products; Star Fittings Div.
i. Victaulic Co. of America.
j. Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Available Manufacturers:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Available Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Available Manufacturers:

a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Available Manufacturers:

a. CECA, LLC.
b. Merit.

2.6 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.
3. Available Manufacturers:

a. Grinnell Fire Protection.
b. McWane, Inc.; Kennedy Valve Div.
c. NIBCO.

d. Stockham.

C. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Available Manufacturers:

1) Global Safety Products, Inc.
2) Milwaukee Valve Company.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.

a. Available Manufacturers:

1) Central Sprinkler Corp.
2) Global Safety Products, Inc.
3) McWane, Inc.; Kennedy Valve Div.
4) Mueller Company.
5) NIBCO.
6) Pratt, Henry Company.
7) Victaulic Co. of America.

D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Available Manufacturers:

a. AFAC Inc.
b. American Cast Iron Pipe Co.; Waterous Co.
c. Central Sprinkler Corp.
d. Clow Valve Co.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Firematic Sprinkler Devices, Inc.
h. Globe Fire Sprinkler Corporation.
i. Grinnell Fire Protection.
j. Hammond Valve.
k. Matco-Norca, Inc.
l. McWane, Inc.; Kennedy Valve Div.
m. Mueller Company.
n. NIBCO.
o. Potter-Roemer; Fire Protection Div.
p. Reliable Automatic Sprinkler Co., Inc.
q. Star Sprinkler Inc.
r. Stockham.
s. United Brass Works, Inc.
t. Venus Fire Protection, Ltd.
u. Victaulic Co. of America.
v. Watts Industries, Inc.; Water Products Div.

E. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Available Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Hammond Valve.
3) NIBCO.
4) United Brass Works, Inc.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Available Manufacturers:

1) Clow Valve Co.
2) Crane Co.; Crane Valve Group; Crane Valves.
3) Crane Co.; Crane Valve Group; Jenkins Valves.
4) Hammond Valve.
5) Milwaukee Valve Company.
6) Mueller Company.
7) NIBCO.
8) Red-White Valve Corp.
9) United Brass Works, Inc.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch Visual.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Available Manufacturers:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Available Manufacturers:

1) Central Sprinkler Corp.
2) Grinnell Fire Protection.
3) McWane, Inc.; Kennedy Valve Div.
4) Milwaukee Valve Company.
5) NIBCO.
6) Victaulic Co. of America.

2.7 UNLISTED GENERAL-DUTY VALVES

A. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

B. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

C. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Available Manufacturers:

a. AFAC Inc.
b. Central Sprinkler Corp.
c. Firematic Sprinkler Devices, Inc.
d. Globe Fire Sprinkler Corporation.
e. Grinnell Fire Protection.
f. Reliable Automatic Sprinkler Co., Inc.
g. Star Sprinkler Inc.
h. Venus Fire Protection, Ltd.
i. Victaulic Co. of America.
j. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

B. Automatic Drain Valves: UL 1726, NPS 3/4 ball-check device with threaded ends.

1. Available Manufacturers:

a. AFAC Inc.
b. Grinnell Fire Protection.

2.9 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Available Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Firematic Sprinkler Devices, Inc.
4. Globe Fire Sprinkler Corporation.
5. Grinnell Fire Protection.
6. Reliable Automatic Sprinkler Co., Inc.
7. Star Sprinkler Inc.
8. Venus Fire Protection, Ltd.
9. Victaulic Co. of America.
10. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:
1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Pendent sprinklers.
3. Sidewall sprinklers.
4. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Plastic, white finish, one piece, flat.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 HOSE CONNECTIONS

A. Available Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Grinnell Fire Protection.
8. Guardian Fire Equipment Incorporated.

9. McWane, Inc.; Kennedy Valve Div.
10. Mueller Company.
11. Potter-Roemer; Fire-Protection Div.
12. United Brass Works, Inc.

B. Description: UL 668, brass or bronze, 300-psig (2070-kPa) minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type.
2. Finish: Rough chrome-plated.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Available Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Guardian Fire Equipment Incorporated.
8. Potter-Roemer; Fire-Protection Div.
9. Reliable Automatic Sprinkler Co., Inc.
10. United Brass Works, Inc.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
1. Type: Exposed, projecting, with two inlets and round escutcheon plate.
2. Finish: Rough chrome-plated.

2.12 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Available Manufacturers:

a. AFAC Inc.
b. Central Sprinkler Corp.
c. Firematic Sprinkler Devices, Inc.
d. Globe Fire Sprinkler Corporation.
e. Grinnell Fire Protection.
f. Reliable Automatic Sprinkler Co., Inc.
g. Star Sprinkler Inc.
h. Viking Corp.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Available Manufacturers:

a. ADT Security Services, Inc.
b. Grinnell Fire Protection.
c. ITT McDonnell & Miller
d. Potter Electric Signal Company.
e. System Sensor.
f. Viking Corp.
g. Watts Industries, Inc.; Water Products Div.

D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Available Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.
b. Potter Electric Signal Company.
c. System Sensor.

2.13 PRESSURE GAGES

A. Available Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS, GENERAL

A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

C. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.

3.2 STANDPIPE SYSTEM PIPING APPLICATIONS

A. Grooved-end, black or galvanized, standard-weight steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

A. NPS 1-1/2 and Smaller: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

B. NPS 2 and Larger: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

C. NPS 2 and Larger: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.4 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

   a. Shutoff Duty: Use butterfly or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

   a. Shutoff Duty: Use butterfly or gate valves.

b. Throttling Duty: Use globe valves.

3.5 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

3.6 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.

3.7 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install drain valves on standpipes.

J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

K. Install alarm devices in piping systems.

L. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Fill wet-standpipe system piping with water.

P. Fill wet-pipe sprinkler system piping with water.

3.8 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.9 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Sprinkler Finishes:

   a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
   b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

3.10 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.11 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install hose-connection valves with flow-restricting device, unless otherwise indicated.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install freestanding-type, fire department connections in level surface.

1. Install protective pipe bollards on three sides of each fire department connection.

C. Install ball drip valve at each check valve for fire department connection.

3.13 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 16.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 16 Section "Grounding and Bonding."

I. Connect wiring according to Division 16 Section "Conductors and Cables."

3.14 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 15 Section "Mechanical Identification."

3.15 FIELD QUALITY CONTROL

A. 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Coordinate with fire alarm tests. Operate as required.
5. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION 13915

DIVISION 15
MECHANICAL SPECIFICATION

15000 GENERAL

15010 GENERAL REQUIREMENTS

15050 BASIC MATERIALS AND METHODS

15051 BASIC MATERIALS AND METHODS GENERAL REQUIREMENTS
15070 VIBRATION ISOLATION AND SEISMIC RESTRAINT
15075 PIPE AND EQUIPMENT IDENTIFICATION

15080 MECHANICAL INSULATION

15081 DUCT INSULATION
15083 CULINARY WATER PIPE INSULATION
15085 PVC VENT PIPING INSULATION
15087 REFRIGERATION PIPE INSULATION

15100 BUILDING SERVICES PIPING

15101 PIPE AND PIPE FITTINGS
15140 HOT AND COLD WATER SYSTEMS
15150 SOIL, WASTE AND VENT PIPING SYSTEM
15181 CONDENSATE DRAIN PIPING
15184 REFRIGERANT PIPING AND SPECIALTIES
15192 NATURAL GAS PIPING

15400 PLUMBING FIXTURES AND EQUIPMENT

15410 PLUMBING FIXTURES
15481 GAS-FIRED WATER HEATER

15500 HEAT GENERATION

15532 GAS FIRED FURNACES
15557 AIR PIPING

15600 REFRIGERATION

15671 AIR COOLED CONDENSING UNITS

15700 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

15729 INDRECT GAS FIRED MAKE-P AIR UNITS WITH EVAPORATIVE COOLING

15800 AIR DISTRIBUTION

15805 KITCHEN GREASE HOOODS

15812 ROUND STEEL DUCTWORK
15814 WELDED BLACK STEEL DUCTWORK
15816 STEEL DUCTWORK
15818 FLEXIBLE DUCT
15819 DUCTWORK TESTING
15820 DUCTWORK ACCESSORIES
15821 FIRE DAMPERS
15822 ACOUSTICAL DUCT LINER
15836 EXHAUST FANS
15851 DIFFUSERS, REGISTERS AND GRILLES
15853 ROOF MOUNTED AIR INLETS AND OUTLETS
15861 AIR FILTERS

15900 HVAC INSTRUMENTATION AND CONTROLS

15915 ELECTRIC AND ELECTRONIC CONTROLS
15941 SEQUENCE OF OPERATION

15950 TESTING, ADJUSTING AND BALANCING

15960 AIR SYSTEM TEST AND BALANCE
15990 FINAL TEST RUN

SECTION 15010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. General Conditions and Division 01 apply to this Division.

1.2 SCOPE:

A. Includes -
   1. Furnish all labor, materials, and equipment necessary for completion of the mechanical work for the Renovation of Buildings 508 and 510 Utah National Guard, Camp W.G. Williams.
   2. Furnish and install all motors specified in this Division and be responsible for the proper operation of electrical powered equipment furnished by this Division.
   3. Furnish exact location of electrical connections and information on motor controls to Division 16.
   4. Placing the air conditioning, heating, ventilating, and exhaust systems into full operation and continuing their operation during each working day of testing and balancing.
   5. Making changes in pulleys, belts, and dampers, or adding dampers, as required for the correct balance as recommended by Balancing Contractor at no additional cost to Owner.
   6. Air balance, final adjustment and test run.
   7. The satisfactory performance of the completed systems is a requirement of this specification.

B. Related Work Specified Elsewhere -
   1. Conduit (unless specified otherwise), line voltage wiring, outlets, and disconnect switches specified in Division 16.
   2. Magnetic starters and thermal protective devices (heaters) not a factory mounted integral part of packaged equipment are specified in Division 16.

1.3 SITE INSPECTION:

A. The Contractor shall examine the site and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

1.4 DRAWINGS:

A. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc; however, locations are to be regarded as shown diagrammatically only. Follow as closely as actual building construction and work of other trades will permit.

B. Because of the small scale of mechanical drawings, it is not possible to indicate

all offsets, fittings, and accessories which may be required. Investigate existing structural and finished conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

C. If changes in location of piping, equipment, ducts, etc. are required due to lack of coordination of work under this division, such changes shall be made without charge. Contractor shall review drawings with local and state agencies having jurisdiction and any changes required by them shall be brought to the attention of the Architect prior to bidding or commencement of work.

D. The contract drawings shall not be scaled for rough-in measurements, nor be used as shop drawings. Where drawings are required for these purposes, the Contractor shall obtain data from the drawings and take the necessary field measurements. Drawings required by the General Conditions shall include such information as needed to satisfy the Architect on the methods of construction.

1.5 CODE REQUIREMENTS, FEES, AND PERMITS:

A. The work shall be installed in accordance with the following applicable codes, ordinances and standards unless otherwise specified. The codes and standards shall include but not be limited to and be of the latest and current editions.

1. American Gas Association (AGA)
2. Air Movement and Control Association (AMCA)
3. American National Standards Institute (ANSI)
4. Air Conditioning & Refrigeration Institute (ARI)
5. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
6. American Society of Mechanical Engineers (ASME)
7. American Society of Testing Materials (ASTM)
8. American Standards Association (ASA)
9. American Water Works Association (AWWA)
10. American Welding Society (AWS)
11. Associated Air Balance Council (AABC)
12. National Electrical Code (NEC)
13. National Fire Protection Association (NFPA)
14. Sheet Metal and Air Conditioning contractors National Association (SMACNA)
15. Underwriters Laboratories (UL)
16. International Building Code (IBC) 2006
17. International Mechanical Code (IMC) 2006
18. International Plumbing Code (IPC) with Utah Amendments 2006
19. Utah State Safety Orders (OSHA/UOSH)
20. Utah Fire Rating Bureau
21. Utah Boiler and Pressure Vessel Law
22. Utah Air Conservation Regulations/Waste Disposal regulations.
23. ASHRAE Ventilation STD.62-2004
24. Energy Code for Commercial and High Rise Building ANSI/ ASHRAE/IESNA 90.1-2004.

B. Should drawings conflict with any code, the code shall govern. If drawings and specifications establish a quality exceeding the code, the drawings and

specifications shall govern. If conflicts do exist among the drawings, specifications and codes, the same shall be brought to the attention of the Architect in writing prior to bidding, otherwise Contractor shall comply with applicable codes.

C. The latest edition of all codes shall be used.

D. Contractor shall give all notices, obtain all necessary permits, file necessary plans, prepare documents and obtain approvals, and pay all fees required for completion of the mechanical and plumbing work outlined in this Division of the specifications and shown on the Mechanical Drawings.

1.6 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:

A. Upon completion of work and before final payment, Contractor shall furnish and deliver to the Owner, through the Architect, three (3) sets of installation, operating and maintenance manuals and instructions for all new materials and mechanical equipment used in the building.

B. Bind Operation and Maintenance Manual for Mechanical Systems in a hard-backed piano hinge loose-leaf binder with strong sturdy cover. The following lettering shall be stamped on front and spline of each binder:

OPERATION
AND
MAINTENANCE
MANUAL
for MECHANICAL SYSTEMS of
(Name of Project)
(Location of Project)
(Name of Architect)

C. The first section is to contain the following information.

1. First page shall be a table of contents including name of project, date awarded and date of substantial completion.
2. Second page shall contain the names, phone numbers and addresses of Architect, Consulting Engineers, and Associates.
3. Third page shall contain a list of names, addresses and phone numbers of contractors and all sub-contractors and work to which each was assigned.
4. Final page or pages shall contain an equipment list. The list shall contain each item of equipment or material for which a submittal was required giving ID or tag no as contained on the drawings make and model No. Serial No. Identification No. Location in building, function and name address and phone number of supplier.

D. The second section shall contain

1. Description of each operating system included location of switches, breakers thermostats control devices. Provide a single line diagram, showing set points, normal operating parameters for all loads, pressures, temperatures and flow check points; Describe all alarms and cautions for operation.
2. Provide schematic control diagrams, panel diagrams, wiring diagrams etc (blue line prints) for each separate fan system, chilled water system, hot

water system, exhaust air system, pumps, etc. each control diagram shall show a schematic representation of mechanical equipment and location of start-stop switches, insertion thermostats, thermometers, pressure gauges, automatic valves etc. The correct reading for each control instrument shall be marked on the diagram.

E. The third section shall contain a comprehensive lubrication list and maintenance schedule for equipment with moving parts. If bearings are sealed equipment shall still be included and a statement to indicate no lubrication or maintenance required.

F. The fourth section shall contain a complete air test and balance report. The report shall contain name, address and phone number of agency. Name and certification of their mechanical engineer, list of equipment with date of last calibration.
   1. Floor plans showing all air openings and thermometer location clearly marked and cross reference with data sheets. Formatted may be 8 1/2 x 11 or 11x14 if legible.
   2. Data sheets showing amount of air handled at each setting see section 15960.

G. The fifth section shall contain data on plumbing fixtures and equipment.
   1. Section shall contain general product catalog cuts, approved submittal sheets and exploded view drawings with parts lists for all valves and other items with multiple parts.

H. The final sections shall be one for each individual item for which a submittal sheet was required. Each section shall include:
   1. Equipment descriptions
   2. Detailed installation instruction, operating and maintenance instructions (provided more than just product operations and maintenance instructions provided with unit where required. Instructions should be written in a step by step manner identifying start-up, operating, shutdown and emergency action sequence sufficiently clear so a person unfamiliar with the equipment could perform its operations.
   3. Equipment drawings, performance curves, operating characteristics, etc.
   4. Name addresses and phone number of manufacturer, fabricator and local vender clearly printed or stamped on cover.
   5. Complete parts listing which include catalog number, serial number, contract number or other accurate provision for ordering replacement and spare parts.
   6. Certified drawings, where applicable, showing assembly of parts and general dimensions.
   7. General product and approved submittal sheets.

I. Drawings and reproducible masters of drawings as required in individual specification sections, are not to be bound in volumes but are to be delivered separate with the maintenance manuals.

J. Equipment to be covered:
   1. Mechanical equipment
   2. Plumbing fixtures and equipment.
   3. Automatic controls and sensing systems
   4. Any item for which a submittal is required.

1.7 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Contractor shall instruct building maintenance personnel in the operation and maintenance of the installed mechanical systems utilizing the Operation and Maintenance Manual when so doing.

B. Minimum instruction periods shall be as follows -
   1. Mechanical - Six hours.
   2. Plumbing - Two hours
   3. Temperature Control - Four hours.

C. Instruction periods shall occur before final inspection when systems are properly working and before final payment is made.

D. None of these instructional periods shall overlap each other.

E. An additional two hours of instruction will be provided by each contractor, after 60 days of system operation by owner to insure proper system operation and answer questions.

1.8 RECORD DRAWINGS:

A. Contractor shall keep an up-to-date set of mechanical and plumbing drawings in his custody showing all changes in red, clearly defined and neatly drafted by him. At the end of construction, he shall turn these drawings over to the Architect. Record drawings must be completed and submitted prior to final inspection.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 15010

SECTION 15051 - BASIC MATERIALS & METHODS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. Division 15010 General applies to this Section.

1.2 COORDINATION OF WORK:

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for the installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making application to the Architect in writing. Should conditions arise where certain changes would be advisable, secure Owner's and Architect approval for these changes before proceeding with work.

B. Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Architect. Changes required in work specified in Division 15 caused by neglect to secure approval shall be made at no cost to Owner.

C. Arrange piping, ductwork, and equipment to permit ready access to valves, unions, starters, motors, control components, and to clear openings of doors and access panels. Contractor shall provide all necessary access doors and/or panels to provide complete access to all mechanical equipment, dampers, or accessories. Doors for dampers, etc. shall be minimum 12" x 12" and doors for mechanical equipment shall be minimum 24" x 24".

D. Furnish and install supports required by Division 15 unless otherwise noted. Furnish supports, and equipment that are an integral part of other Divisions involved in sufficient time to be built into the construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Contractor.

E. Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Owner and Architect. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

1. Patch and repair walls, floors and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
2. This Division shall bear expense of cutting, patching, repairing, and replacing of work of other Divisions because of its fault, error, tardiness, or because of damage done by it.
3. Provide the necessary cutting, patching, repairing, and replacing pavements, sidewalks, etc. to permit installation of work of this Division.

F. Adjust locations of piping, ductwork, equipment, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and cut prior to fabrication.

1. Make offsets, transitions, and changes in direction of piping, ductwork,

and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

G. Slots and openings through floors, walls and roofs shall be provided by this Division.

H. This Contractor shall schedule his work, store his equipment and materials, and work in harmony with other Contractors so as to not delay or jeopardize the construction.

I. This Division shall coordinate with electrical contractor to insure that all required components of control work are included and fully understood. Any discrepancies shall be called to the attention of the Architect before completion of bids. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.3 EQUIPMENT & MATERIALS:

A. Requests for substitution shall be received in writing a minimum of seven days prior to bidding. Prior acceptance shall be by Manufacturer's name only. Items not listed in this specification or subsequent addendums shall not be considered. No oral approvals will be acceptable. Manufacturers listed in this specification are acceptable only for items listed. All other items manufacturer wishes to bid must be prior approved. All equipment shall be subject to final review in accordance with "Project Submittals".

B. Product Approvals -
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

C. Use <u>domestic made</u> pipe, pipe fittings, and motors on Project.

D. Motor and equipment name plates as well as applicable UL labels shall be in place when Project is turned over to Owner.

E. Insure that items to be furnished fit spaces available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. Do not scale off drawings.

F. All materials shall be of the best commercial quality obtainable, consistent with specified materials and for the purpose or function intended. Materials shall be new unless specifically excepted.

G. Equipment catalog or model numbers shown define the basic equipment types and quality standard only. Catalog numbers shall not be considered as all inclusive and shall be verified to include all devices, controls, operators, and appurtenances necessary for the satisfactory and complete operation of the equipment.

H. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
   1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain Architect’s written instructions before proceeding with work. Contractor shall bear all

expenses arising from correcting deficiencies of work that does not comply with Manufacturer's directions or such written instructions from Architect.

I. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.

1.4 PROJECT SUBMITTALS:

A. Furnish complete catalog data for manufactured items of equipment to be used in the Work to Architect for review within 15 days after award of Contract.

B. Submittal shall include, but not be limited to the following:
   1. equipment scheduled
   2. balancing contractor
   3. insulation
   4. grilles, and diffusers
   5. automatic temperature controls
   6. certificates of guarantee
   7. valves
   8. plumbing fixtures, accessories, and specialties
   9. any item for which more than one manufacturer is mentioned

C. Submit a minimum of five copies of data in binders and index in same order and name as they appear in Specification.
   1. State sizes, capacities, brand names, motor HP, electrical requirements, accessories, materials, gauges, dimensions, and other pertinent information.
   2. List on catalog covers page numbers of submitted items.
   3. Underline or highlight applicable data.

D. If material or equipment is not as specified or submittal is not complete, it will be rejected.

E. Catalog data or shop drawings for equipment which are noted as being reviewed by Architect shall not supercede Contract Documents.

F. Review comments of Architect shall not relieve this Division from responsibility for deviations from Contract Documents unless Architect's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

G. Check work described by catalog data with Contract Documents for deviations and errors.

H. All items other than first named specified equipment shall show and state all exceptions and deviations taken and shall include design calculations and drawing layouts.

I. The Contractor shall review the submittals prior to submission to the Architect to make sure that the submittals are complete in all details. No submittal will be reviewed which does not bear the contractor's notation that such checking has been made.

J. No partial submittals will be considered unless approved by the Architect’s engineer.

K. Manufacturers' names shall be mentioned as acceptable prior to bidding. See

paragraph 3a above.

L. Contractor shall verify equipment dimensions to fit the spaces provided with sufficient clearance for servicing the equipment.

M. Contractor shall review equipment submittals for compliance with schedules, specifications, and drawing plans and details. Equipment submittal shall show the proper arrangements to suit installation and maintenance such as motor location, access doors, filter removal, piping connections, etc.

N. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment. Submittals shall clearly indicate name of manufacturer of each item.

O. For unacceptable items, the right shall be reserved to require the first named specified items.

P. Where submittals are sent to Architect with any of the above listed information missing or are incomplete they will be returned to the contractor unchecked to be completed and resubmitted. No additional time or money shall be allowed for failure to provide complete submittals on the first review.

Q. If an item requiring submittal review is ordered, purchased, shipped, or installed prior to the submittal review and is subsequently disapproved the item shall be removed from the job site and replaced with an approved item at contractors expense.

1.5 CLEANING & FINISHING:

A. Contractor shall, at all times, keep the premises free from waste material and rubbish. Upon completion of this Section of the work, Contractor shall remove all surplus materials and rubbish; clean all spots resulting from the mechanical work from hardware, floors, glass, walls, etc.; do all required patching up and repair all work of other trades damaged by Contractor under this Section of the work, and leave the premises in a clean orderly condition. Clean heating and cooling coils, internally and externally, and replace all air filters prior to final mechanical inspection. Remove rust, plaster, dirt, grease and oil before painting, insulating, or exposing to view the equipment, piping, ductwork, etc. in completed structure. Refinish any damaged surfaces and leave in proper working order at final completion.

1.6 EQUIPMENT SERVICING:

A. Prior to starting mechanical equipment, all motors, bearings and moving parts shall be properly oiled, greased and lubricated as required. Full and adequate maintenance service shall be given and upon completion all equipment shall be cleaned and checked and placed in perfect condition for the Owner.

B. Provide lubrication for the following:
   1. Furnaces
   2. Exhaust fans
   3. Damper motors
   4. Condensing Units
   5. Make-up Air Units

C. Amount and type of lubricant shall be per manufacturer's specification.

1.7 SUPERVISION:

A. The Contractor shall supervise and direct the work with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will be responsible to see that the finished work complies accurately with the Contract Documents.

1.8 SAFETY REGULATIONS:

A. Contractor shall provide equipment, supervision, construction, procedures, and everything necessary to assure safety of life or property.
B. Refer also to General Condition and Special Conditions for protection clauses.

1.9 LEAK DAMAGE:

A. Contractor shall be responsible for damages to the work of other Contractors or to the building, or to its contents, people, etc., caused by leaks in any of the equipment or piping installed by him through equipment or material failures, leaking joints or disconnected pipes, fittings, or by overflows and shall make at his own expense all repairs to fixtures, building interior, contents, paint, rugs, furniture, ceiling tile, and equipment so damaged.

1.10 TOOLS AND STORAGE OF EQUIPMENT:

A. The Contractor shall furnish all necessary tools, staging and whatever may be necessary for the installation of this work and shall at all times protect this work and others, and the materials to be used therein from damage by the weather, accident and other causes, and shall repair and make good any damage thus occurring.

1.11 WORKMANSHIP:

A. Workmanship shall be the best quality of its kind for respective industries, trades, crafts and practices and shall be acceptable in every respect to the Owner and Engineer. Nothing contained herein shall relieve the Contractor from performing good work, perfect in all details of construction.

1.12 TEMPORARY FACILITIES:

A. Furnishing of temporary water, space heating, sanitary facilities, drainage lines, light and power will be as specified in Division 01 General Conditions. Contractor shall arrange to bring facilities to required location of premises. All expenses involved shall be paid by the Contractor as described in General and Special Conditions.

1.13 PAINTING BY CONTRACTOR:

A. See section 09900 for painting requirements. See also section 15075 for color code requirements.

B. Painting shall be by persons experienced in painting.

C. All exposed, insulated, and bare piping, equipment, metal stands and supports shall be painted as follows:

1. The finish coat on equipment, grilles, and diffusers shall be factory applied.
2. All equipment which is to be furnished in finished painted condition by Contractor shall be left without mark, scratch or impairment to finish upon completion and acceptance of job. Any necessary refinishing to match original shall be done by Contractor. Do not paint over name plates, serial numbers or other identifying marks.
3. All new piping shall be painted as required in Section 15075. Paint colors shall conform to color code requirements as specified in 15075 "Identification of Piping and Equipment".

1.14 ELECTRICAL WORK:

A. Power wiring to all electrically driven apparatus shall be done under the electrical contract. See Electrical Specifications.

B. Unless specifically noted otherwise on documents, Electrical Contractor shall furnish and install all magnetic starters including properly sized heaters, and disconnect switches as indicated on drawings or required by code.

C. The Contractor shall verify the proper operation of equipment furnished by him. Costs for repair, replacing, re-wiring and retesting shall be borne by the Contractor without additional costs to the Owner.

1.15 CONTRACTOR'S USE OF BUILDING EQUIPMENT:

A. The Contractor may use equipment such as electric motors, fans, filters, etc. when permanently installed as part of the project and with the written permission of the Owner. As each piece of equipment is used, maintenance procedures approved by the manufacturer shall be followed, a careful record shall be kept of the time used, maintenance procedure following and of any difficulty experienced with equipment. The Contractor's records on the equipment shall be submitted to the Owner upon acceptance of project. All fan belts and filter media shall be new at the beginning of the Mechanical System Operating Test Run and System Balancing. Wearing surfaces (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted shall require replacement.

1.16 INSPECTION NOTICE:

A. The following is a basic list of guideline items so that the Architect, district building inspector/Owner’s representative can be at job site for these inspections as the building progresses. Mechanical Contractor shall inform these people one week in advance of test time.

1. Water tests on all sewer, waste, and rainwater piping prior to piping being concealed.
2. Pressure tests on all water service piping.
3. All duct work prior to installation of finished ceilings, including ductwork pressure testing.

4. The initial start-up of mechanical equipment, etc.
5. Any changes or problems occurring at job site.
6. Inspect all vent flashings on roof prior to roofing.
7. Periodic inspection at their discretion will be made to insure compliance to Contract Documents and codes. Contractor shall provide ladders, access and other assistance as requested during inspections.
8. Final inspection before giving approval for final payment.

1.17 EXCAVATION AND BACKFILLING:

A. Trench for the underground gas pipe line shall be excavated to the required depth. Rocks, trash, or other debris will not be allowed in trench or backfill and shall be removed before pipe is laid in place. After piping has been tested, inspected and approved, piping shall be backfilled. All landscaping, concrete, etc., damaged by this Contractor shall be replaced by him to the satisfaction of Owner's Representative.

1.18 WARRANTY GUARANTEE:

A. The Contractor shall warrant all materials and equipment to be of quality consistent with specifications as represented by manufacturer's published data.
B. The Contractor shall guarantee that the installation and operation of the equipment shall be free from defects for a period of one year beginning at date of substantial completion and acceptance. The Contractor shall replace or repair any part of the installation that is found to be defective or incomplete within the guarantee period.
C. The one year guarantee on equipment and systems shall commence when equipment has been demonstrated to work and has been accepted. (Example: If an equipment item fails to perform and it takes 9 months after substantial completion to correct, then the guarantee shall commence after the item has been demonstrated to perform and has been accepted.)
D. Substantial completion and acceptance in no way relieves the Contractor from providing the systems and equipment as specified.

1.19 COMPLETION SCHEDULE:

A. Start-up and verification of basic equipment items shall be done prior to the date of substantial completion with sufficient time to allow balancing and adjusting to be performed.
B. At the time of the final inspection a date shall be agreed upon for completion of any remaining items. At least double the estimated cost of the work will be withheld from the Contractor's payment.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 15051

SECTION 15070 VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing engineering and materials necessary for vibration isolation and seismic restraints for equipment contained herein for the project.
   1. Other Sections of DIVISION 15 for a part of this section. Refer to all sections for a complete description of the work
   2. Section 15101 - Pipe and Pipe Fittings
   3. Section 15535 - Refrigeration piping and specialties

B. All mechanical equipment .75 HP and over listed in the equipment schedule shall be mounted on vibration isolators to prevent the transmission of object able vibration and vibration induced sound to the building structure.
   1. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer and shall be certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
   2. The contractor and manufacturer of the isolation and seismic equipment shall refer to the isolator and seismic restraint schedule which lists isolator types, isolator deflections and seismic restraint type. Vibration isolators shall be selected in accordance with the equipment, pipe or duct weight distribution so as to produce reasonably uniform deflections.

C. Install full line size flexible pipe connectors at the inlet and outlet of each condensing unit, cooling coil connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipe fitting schedule. Control rods or protective braid must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.

D. Unless otherwise specified, all mechanical, electrical, and plumbing equipment, pipe, and duct shall be restrained to resist seismic forces. Restraints shall maintain equipment, piping, and duct work in a captive position. Restraint devices shall be designed and selected to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.
   1. For this project all systems shall be considered to be essential with an Ip=1.5

1.2 SEISMIC RESTRAINT SHALL NOT BE REQUIRED FOR THE FOLLOWING

A. Rigidly floor mounted mechanical, electrical, and plumbing components in all seismic design categories, where Ip=1.0 and flexible connections between the components and associated ductwork, piping and conduit are provided, that are mounted at 4 feet (1219 mm) or less above a floor level and weight 400 pounds (1780) or less and are not critical to the continued operation of the structure. Suspended, wall mounted and flexibly mounted equipment are not included in this exclusion.

B. Hanging, wall mounted, and flexibly supported mechanical, plumbing and electrical components that weigh 20 pounds (89 N) or less, where Ip=1.0 and flexible connections are provided between the components and associated duct work, piping and conduit.

C. Piping supported by individual clevis hangers where the distance, as measured from the top of the pipe to the supporting structure, is less than 12 inches (305mm) for the entire pipe run and the pipe can accommodate the expected deflections. Trapeze or double rod hangers where the distance from the top of the trapeze or support to the structure is less than 12 inches for the entire run. Hanger rods shall not be constructed in a manner that would subject the rod to bending moments (swivel, eye bolt, or vibration isolation hanger connection to structure).

D. High deformability piping (steel, copper, aluminum with welded, braized, ground, or screwed connections) designated as having an Ip=1.5 and a nominal pipe size of 1 inch (25 mm) or less where provisions are made to protect the piping from impact or to avoid the impact of larger piping or other mechanical equipment. Note, any combination of piping supported on a trapeze where the total weight exceeds 10lb/ft. Must be braced

E. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designed with an Ip=1.0 and a nominal pipe size of 1 inch and less in the mechanical equipment room, or 2" and less outside the mechanical equipment room.

F. PVC or other plastic or fiberglass vent piping.

G. HVAC ducts suspended from hangers that are 12 inches (305 mm) or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections. Duct must be positively attached to hanger with minimum #10 screws within 2" from the top of the duct.

H. HVAC duct with an Ip=1.5 that have a cross-section area less than 4 square feet. HVAC ducts with an Ip=1.0 that have a cross sectional area of less than 6 square feet(0.557 m2)

I. Equipment items installed in-line with the duct system (e.g, fans, heat exchangers, and humidifiers) with an operating weight less than 76 pounds (334 N). Equipment must be rigidly attached to duct at inlet and outlet.

1.3 MANUFACTURER'S RESPONSIBILITIES: Manufacturer of vibration and seismic control products shall have the following responsibilities.

A. Determine vibration isolation and seismic restraint sizes and locations.

B. Provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified.

C. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.

D. Provide calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, Chapter 16 latest edition. Seismic calculations shall be certified by a licensed engineer licensed in the State of Utah in the employ of the seismic equipment manufacturer with a maximun 5 years experience. Provide calculations for all floor or roof mounted equipment 400lbs

(1780 N) or greater (20lbs (89 N) or greater for Ip=1.5), all suspended or wall mounted equipment 20lbs (89 N) or greater, and vibration isolated equipment 20lbs (89 N) or greater.

E. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer licensed in the State of Utah.

F. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compasive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.

1.3 QUALITY CONTROL

A The isolators and seismic restraint systems listed herein are as manufactured by:

1. Amber/Booth.
2. Mason Industries
3. Korfund

d. Vibration Mounting and Controls

Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA)

B. Steel components shall be cleaned and painted with industrial enamel. All nits, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be throughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

C. All isolators, bases, and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts, and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb./sq. Ft. applied to any exposed surface of the equipment.

D. Provide a written quality control procedure that outlines complete compliance of attachment and cabling restrains to brackets. For swaged connections, provide a gage to verify swage. For screw/clamp connection, provide torque values for attachment fasteners.

1.4 SUBMITTALS

A. Submit shop drawings of all isolators, seismic restraints and calculations provided (para 1.3)

B. The manufacturer of vibration isolation products shall submit the following data for each piece of isolated equipment: clearly identified equipment tag, quantity and size of vibration isolators and seismic restraints for each piece of rotating isolated equipment. Submittals for mountings and hangers incorporating spring shall include spring diameter and free height, rated deflections, and solid load. Submittals for bases shall clearly identify locations for all mountings as well as all locations for attachment points of the equipment to the mounting base. Submittals shall include seismic calculations signed and checked by a qualified licensed engineer licensed in the State of Utah in the employ of the manufacturer

of the vibration isolators. Catalog cut sheets and installation instructions shall be included for each type of isolation mounting or seismic restraint used on equipment being isolated.

C. Submit quality assurance procedures as required under 1.4.4 at time of isolator/seismic submittals. Submitals must be stamped by a registered professional engineer licensed in the State of Utah who is responsible for the seismic restraint design. All vibration isolation/seismic submittals not complying with this certification will be rejected.

D. Provide shop drawings indicating location of all specification SC cable restraints (section 2.3.B) required for pipe and ductwork. Drawing must be stamped by manufacturer's registered professional engineer licensed in the State of Utah.

E. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that there is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

F. Provide a certification from the seismic design engineer that the seismic restraints will comply with the applicable code requirements. Certification must be stamped by a registered profession engineer licensed in the State of Utah.

G. Provide a Certificate of Completion from the manufacturer's representative upon completion of the job.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Specification W: a pad type mounting consisting of two layers of ribbed elastomeric pads with a ½" poro-elastic vibration absorptive material bonded between them. Pads shall be sized for approximate deflection of 0.10" to 0.18". Pads shall be Amber/Booth Type NRC.

B. Specification E: a combination spring and elastomeric hanger consisting of a regular steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment, coil spring, spring retainers and elastomeric element designed for approximately ½" deflection. The spring shall be designed for a minimum kx/kx (horizontal-to-vertical spring rate) of 1.0. Spring hangers shall be Amber/Booth Type BSRA.

C. Specification SB: a unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment. Restraints shall allow a maximum of 1/4"movement before engaging and shall allow for the spring to be changed if required. Isolator shallbe a stable spring with a minimum ky/ky of 1.0. The spring package shall include an elastromeric pad for high frequency absorption at the base of the spring. Nuts and bolts shall be zinc-electroplated to prevent corrosion. Bolting equipment yo isolator with bolts smaller than main adjusting bolt will not be allowed. Base plate shall provide means for bolting to the structure. Entire assembly shall be rated to exceed the applied seismic load (para 1.3) Mountings shall be Amber/Booth Type SWSR

2.2 SEISMIC RESTRAINTS:

A. Specification SL: a restraint assembly for floor mounted equipment consisting of welded steel interlocking assemblies welded or bolted Securely to the equipment or the equipment bases and to the supporting structure. Restraint assembly surfaces which engage under seismic motion shall be lined with a minimum 1/4" thick resilient elastromeric pad to protect equipment. Restraints shall be field adjustable and be positioned for 1/4" clearance as required to prevent interference during normal operation. Restraint assembly shall have minimum rating of 2 times the catalog rating at 1 G as certified by independent laboratory tests. Restraint shall be Amber/Booth Type ER.

2.3 FLEXIBLE PIPE CONNECTIONS

A. Specification K: Water Service: For flanged connection - a double sphere arch rubber expansion joint constructed of molded reinforced neoprene with integral steel floating flanges, and designed to be suitable for pressures up to 225 PSI (4 ti 1 safety factor) and temperatures up to 225 degrees F. Connectors shall have minimum movement capabilities of 1.77" compression, 1.18" lateral and 1.18" extension. Connectors shall provide a minimum 35◦ angular movement up to 6", minimum 30◦ up to 12" and minimum 20◦ up to 24". Spring-loaded control units shall be furnished to limit movement to within allowables. Amber/Booth Type 2600

1. Water Service: For threaded type - Double spherical rubber hose connector, minimum 8" long, constructed of molded neoprene, nylon cord reinforced, with female pipe unions each end. Connectors shall have a minimum movement capability of 7/8" compression, 7/8" lateral, 1/4" extension and 20◦ angular through 1-1/4", 13◦ through 2", and 9◦ through 3". Connectors shall be suitable for a maximum working pressure (4 to 1 safety factor) of 150 psi and 225 degree F. Connectors shall have cable control units to limit extension to 1/4". Amber/Booth Type 2655.

PART 3 - EXECUTION

3.1 - GENERAL

A. Isolator and seismic restrains shall be installed as recommended by the manufacturer. Isolate all mechanical equipment 0.75 hp and over per the isolation schedule and these specifications.

3.2 - PIPING ISOLATION

A. Horizontal Pipe Isolation: all HVAC pumped water, pumped condensate, glycol, and refrigerant piping size 1-1/4" and larger within mechanical rooms shall be isolated . Outside equipment rooms this piping shall be isolated for the greater of 50' or 100 pipe diameters from rotating equipment. For the first 3 support locations from externally isolated equipment provide specification E hangers or specification SB or SX floor mounts with the same deflection as equipment isolators (max 2"). All other piping within the equipment rooms shall be isolated with the same specification isolators with a 3/4" minimum deflection. Steam piping size 1-1/4" and larger which is within an equipment room and connected to

retating equipment shall be isolated for three (3) support locations from the equipment. Provide specification E or SB (SX) isolators with the same deflection as the equipment but a minimum of 3/4"

B. All plumbing plumbed water, pumped condensate, and steam piping size 1-1/4" and larger within mechanical rooms shall be isolated the same as HVAC piping (para 3.2.1.) Isolators are not required for any plumbing pumped water, pumped condensate, and steam piping outside of mechanical rooms unless listed in the isolation schedule

C. Pipe Riser Isolation: All variable temperature vertical pipe risers 1-1/4" and larger, riser piping requiring isolation per para 3.2.1 or 3.2.2 or where specifically shown and detailed on riser drawings shall be fully supported by specification B mounts with precompression plates. Steel spring deflection shall be 3/4-inch minimum except in those locations where added deflection id required due to pipe expansion and contrction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the risers in tension. Pipe risers through 16" shall be supported at intervals of every third floor of the building. Pipe risers 18" and over, every second floor. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, reset diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed. Riser supports shall be Amber/Booth Type SWP

3.3 DUCT ISOLATION

A. Isolate all ductwork with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type E hangers or type SB (SX) floor mounts.

3.4 INSTALLATION

A. Comply with manufacturers instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, ad are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary support during installation or shipping.

B. Locate isolation hangers as near the overhead support structure as possible.

C. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

D. Install isolated inertia base frames and steel base on isolator units as indicated so that a minimum of 2 inch clearance below base will result when supported equipment has been installed and loaded for operations.

E. Roof curbs shall be installed directly to building structural steel or concrete roof deck. Installation on top of steel deck or roofing material is not acceptable.

3.5 APPLICATION OF SEISMIC RESTRAINTS

A. Isolated Equipment

1. All floor mounted isolated equipment shall be protected with type SB or type C unitized isolator and restraint or with separate type SL restraints (minimum of 4) in conjunction with type B isolators. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking. All suspended isolated equipment and vessels shall be protected with specification SC restraints. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation.

B. Piping

1. All piping shall be protected in all planes by SC restraints, designed to accommodate thermal movement as well as restrain seismic motion. (Spring-loaded control rods should be used on flexible connectors in system) Tanks and vessels connected inline to piping shall be restrained independently. Locations shall be as determined by the isolator/seismic restraint supplier and shall include, but not be limited to:
   a) At a proximity to protect all drops to the equipment connections.
   b) At changes in direction or pipe as required to limit over stressing of pipe movement that contacts other building material
   c) At horizontal runs of pipe, not to exceed the spacing as presented in Amber/Booth design criteria.
   d) SMACNA design criteria. Seismic restraints shall not be required for piping exempted by paragraph 1.2.
2. Where riser pipes pass through cored holes, core diameters to be a maximum of 2" larger than pipe O.D> including installation. Cored holes must be packed with resilient material or fire stop as provided by other sections of this specification or local codes. No additional horizontal seismic bracing is required. Restrained isolators type C or SB shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints. For risers in pipe shafts, specification SC cable shall be installed at each level in a manner that does not interfere with thermal movement.

C. DUCTWORK

1. Ductwork 6 square feet and larger in cross sectional area shall be protected in all planes by SC restraints. Locations shall be determined by the isolator supplier and shall include, but not limited to:
   a) at equipment connections as required to protect the connections.
   b) at all duct runs and duct run ends (transverse bracing and longitudinal bracing not to exceed spacing specified in Amber/Booth, or SMACNA guidelines)

D. The isolation and/or seismic restante listed shall be furnished and installed for the equipment listed in the table below in accordance with the previous sections of this specification:

EQUIPMENT ISOLATION SCHEDULE

	C' GRADE		
EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFL. (IN)	BASE (1) TYPE
REFRIGERATION UNITS RECIP. COND. UNITS	SWSR	.75	-

SECTION 15075 - PIPE AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE:

A. Piping Identification
   1. All pipes shall be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
      a) Adjacent to each valve.
      b) At every point of entry and exit where piping passes through a wall or floor.
      c) On each riser and junction.
      d) A maximum of every 50 feet on long continuous lines fully exposed to view. Less spacing if one cannot see one code from the adjacent.
      e) Adjacent to all special fittings or devices (regulating valves, etc).
      f) Connection to equipment.

B. Duct Identification
   1. Ductwork shall be identified at or near the fan.

C. Equipment Identification
   1. Identify all equipment including mechanical equipment, ATC panels, junction boxes, and all other devices.

PART 2 - MATERIALS

2.1 PIPING IDENTIFICATION:

A. Labels and markers shall be of the self-sticking, all-temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Ave., Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

B. Pipe color coding shall be uniform throughout the building and comply with requirements of ANSI A13.1.

C. All paint to be Enamel, Moore Impervo and Iron Clad.

D. Letters of identification legend and directional flow arrows shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.

E. Proposed identification system shall be approved by Owner and Architect prior to installation.

2.2 DUCT IDENTIFICATION:

A. Ductwork shall be identified at or near the fan, with stenciled signs or by engraved laminated plastic signs secured with rust proof screws. Sign shall indicate area served and direction of air flow.

2.3 EQUIPMENT IDENTIFICATION:

A. Equipment shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters. Signs shall be securely attached by rust proof screwed or some other permanent means (no adhesives).
B. Information on signs shall include name of equipment, identification on plans and schedules, rating maintenance instructions and any other important data not included on factory attached name plate.

PART 3 - EXECUTION

3.1 PIPING IDENTIFICATION:

A. Markers shall be installed in strict accordance with manufacturer's instructions. Use vinyl tape first and stick markers over tape. This procedure assures that the tape will not fall off.
B. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass covering, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
C. On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.
D. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling, is used, letter heights, background colors, banding and arrows shall be as specified above. Submit sample to Owner before proceeding with work.
E. Apply markers so they can be read from floor.

3.2 DUCT IDENTIFICATION:

A. Identify all ducts exposed in mechanical equipment room. A sample duct identification shall be as follows: Supply air VAV System Administration offices.

3.3 EQUIPMENT IDENTIFICATION:

A. Signs shall be attached to equipment so they can be easily read. Attachment shall be by screws or rivets. Glue shall not be used.
B. A sample identification sign for equipment shall be as follows: AH-1 Air handler single zone Gymnasium 8000 cfm.
C. NOTE: Avoid using only the engineers designations as used on plans; identify equipment as to area or zone served.

3.4 REMOVABLE AND NON-REMOVABLE CEILING TILE:

A. Where valves, adjustment controls, etc. are located above ceiling tile, an identification on the lay in tile tee bar shall be provided to indicate the tile to be removed for access to a particular item. In general, 1/2 inch high black stick on

or stencil letters are to be used indicating the device such as V for Volume Damper, CWV for cold water valve, E for other electrical devices, etc. The code used shall be provided in the operations and maintenance manual.

B. For non-accessible ceiling and ceilings without tee bars, provide hinged access doors at each valve, damper and damper operator.

END OF SECTION 15075

SECTION 15081 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -

1. Insulating of concealed round above grade supply air ducts, fresh air ducts, duct handling evaporative cooled air, and ductwork routed outside of building insulation envelope.
2. Insulating of welded black steel exhaust duct serving grease hood.

B. Related Work specified Elsewhere -

1. Acoustical insulation inside air ducts is specified in Section 15822.
2. Insulated flex duct specified in Section 15818.

PART 2 - PRODUCTS

2.1 INSULATION (ALL DUCTWORK EXCEPT KITCHEN HOOD GREASE DUCT):

A. Insulation shall have surface burning characteristics as determined by ASTM E84 with a flame spread rating of 25 and a smoke developed of 50.

B. 1-1/2 inch thick fiberglass with aluminum foil scrim kraft facing and have a density of one lb/cu ft.

C. Ductwork routed exterior to the building shall be wrapped with 2 inch thick 1 ½ lb. Aluminum foil skrim craft facing and be covered by an aluminum jacket to protect from damage and moisture.

D. Approved Manufacturers:

1. Johns-Manville Microlite FSK
2. CSG Type IV standard duct insulation
3. Owens-Corning FRK-25
4. Knauf (Duct Wrap FSK)

2.2 INSULATION OF KITCHEN HOOD GREASE DUCT:

A. Insulation shall be rated non combustible per ASTM E-136.

B. Insulation shall have surface burning characteristics per ASTM-84/UL723 of flame index 0 and smoke index 0.

C. 1 ½ - 2 inch thick ceramic fiber or alkaline earth silicate fiber 8 lb/ft^3 with aluminum facing or totally encapsulated foil covering and when properly installed shall require 0 clearance to grease duct thus eliminating the need for sheetrock enclosure.

D. Include ICC-ES 1 hr evaluation report in submittals.

E. Approved Manufacturers

1. Firemaster Duct Wrap 2x2+ by Thermal Ceramics or equal by

   a. CertainTeed Corp.; FlameChek.
   b. Johns Manville; Firetemp Wrap.
   c. 3M; Fire Barrier Wrap Products.
   d. Vesuvius; PYROSCAT FP FASTR Duct Wrap.
   e. Prior approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION ALL DUCTS EXCEPT KITCHEN GREASE DUCT:

A. Install duct wrap in accordance with Manufacturer's recommendations.

B. Do not compress insulation except in areas of structural interference.

C. Joints shall be completely sealed.

3.2 INSTALLATION KITCHEN GREASE DUCT:

A. Install a double layer of insulation as required to meet 0 clearance, 2 hour rating for entire length of duct per manufacturers recommendations and as required by code.

B. Do not compress insulation.

C. Joints shall be per manufacturers recommendation to provide 0 clearance rating.

END OF SECTION 15081

SECTION 15083 - CULINARY WATER PIPE INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of all above ground culinary hot water, recirculating hot water, and cold water lines and fittings, and underside of wall hung lavatories for handicapped.
   2. The insulation products used on the project shall be of one manufacturer, unless specifically excepted. All pipe insulation shall meet the requirements of IBC.
   3. Insulation products on this project shall be installed by a licensed insulation contractor using materials, and methods described in this section. Installation by other than an experienced licensed contractor shall not be acceptable.

PART 2 - PRODUCTS

2.1 INSULATION:

A. Snap-on glass fiber pipe insulation with surface burning characteristics as determined by ASTM E84 with a flame spread rating not to exceed 25 and smoke developed not to exceed 50.
B. Snap-on glass fiber pipe insulation. Heavy density pipe insulation with a factory applied ASJ jacket.
C. Approved Manufacturers:
   1. Owens-Corning
   2. Johns-Manville
   3. Knauf
D. Thickness shall be as noted in Table 1.

2.2 COVERING:

A. Where piping is susceptible to damage, and/or routed below 6'0" above finished floor, provide with heavy duty PVC jacket.
   1. Jacket material shall be a minimum of .030 inches thick and white in color unless directed otherwise by Architect.
   2. Approved Manufacturers
      a) Ceel-Tite 320 by Ceel Co.
      b) Prior approved equal

PART 3 - EXECUTION

3.1 PIPING:

A. General

1. Pipe insulation shall be continuous through the sleeve.
2. A PVC jacket shall be provided over the insulation wherever caulking is required.
3. Insulation shall be continuous through hangers.
4. Support points such as hangers or rollers shall have a calcium silicate support block. See section 15101.

B. Cold Lines

1. Insulation shall be applied to clean, dry pipe with joints tightly butted and the ends of the insulation sealed off with vapor barrier coating at intervals not to exceed 15 feet.
2. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
3. All laps and butt strips shall be secured with adhesive and stapled on 4-inch centers.
4. Staples and seams, including those on self-sealing lap systems shall be coated with a vapor barrier coating.
5. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating as specified for butt strips. The patch shall extend not less than 1-1/2 inches past the break.
6. At penetrations such as thermometers, the void in the insulation shall be filled with vapor barrier coating and the penetration shall be sealed with a brush coat of the same coating.

C. Hot Lines

1. Insulation shall be applied to clean, dry pipe with joints tightly butted.
2. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
3. Laps and butt strips shall be secured with adhesive and stapled on 4-inch centers. Adhesive may be omitted where pipe is concealed.
4. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as noted for butt strips. Patch shall extend not less than 1-1/2 inches past the break.
5. The run of the line pipe insulation shall have the ends brought up to the item.

3.2 FITTINGS:

1. Insulate fittings with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in or tapered.
2. Cover insulation with one piece "Zeston" type PVC fitting cover or equal by Ceel Co.secured by stapling or taping ends to adjacent pipe covering.
3. Alternate Method -
   a. Insulate fittings with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending two inches onto adjacent insulation.

TABLE 1
Pipe Insulation Thickness

PIPE SYSTEM	PIPE SIZE		
	1" OR LESS	1-1/4" TO 2"	2-1/2" TO 4"
HOT WATER	1/2"	1/2"	-
COLD WATER	1/2"	1/2"	-

END OF SECTION 15083

SECTION 15085 - PVC VENT PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install insulation on Furnace PVC air piping as described in Contract Documents.

B. Related Sections
   1. Section 15557 - Air Piping

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flexible Foamed Pipe Insulation
   1. Thickness -
      a) 1/2 inch for 2 through 3 inch outside diameter pipe.
      b) 1/2 inch sheet for fittings as recommended by Manufacturer.
   2. Approved Manufacturers -
      a) Armaflex by Armstrong
      b) ImcoLock or ImcoShield by IMCOA
      c) Rubatex

B. Joint Sealer
   1. Approved Manufacturers -
      a) Armaflex 520 by Armstrong
      b) Construction Adhesive No. 105 by BFG
      c) 950 Therma-Cel by Rubatex

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
   1. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
   2. Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
   3. Joints -
      a) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
      b) Stagger joints on layered insulation.
      c) Seal joints in insulation.
   4 Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.

B. Install specified insulation on PVC air piping serving mechanical equipment as follows
   1. Combustion air PVC piping in truss space and in attic.

2. Combustion vent PVC piping in attic, in truss space, and above roof.
3. Insulate fittings with sheet insulation and as recommended by Manufacturer.

END OF SECTION 15085

SECTION 15087 - REFRIGERANT PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. Flexible Foamed Pipe Insulation
   1. Thickness -
      a) 1/2 inch for one inch outside diameter and smaller pipe.
      b) 3/4 inch for 1-1/8 through 2 inch outside diameter pipe.
      c) One inch for 2-1/8 inches outside diameter and larger pipe (two layers of 1/2 inch).
      d) One inch sheet for fittings as recommended by Manufacturer.
   2. Approved Manufacturers -
      a) AP Armaflex by Armstrong
      b) Halstead Insul-Tube
      c) Rubatex
B. Joint Sealer
   1. Approved Manufacturers -
      a) Armaflex 520
      b) BFG Construction Adhesive No. 105
      c) Rubatex R-373
C. Insulation Tape
   1. Approved Manufacturers -
      a) Armaflex AP Tape
      b) Rubatex R-180-FS Tape
D. Exterior Finish
   1. Approved Manufacturers -
      a) WB Armaflex Finish by Armstrong
      b) Rubatex Protective Coating 67x944
E. Sleeves - Galvanized 26 ga steel, 9 inches long

PART 3 EXECUTION

3.1 INSTALLATION

A. For condensing units, install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.
B. Install insulation in snug contact with pipe and in accordance with Manufacturer's

recommendations.

1. Insulate flexible pipe connectors.
2. Insulate thermal expansion valves with insulating tape.
3. Insulate fittings with sheet insulation and as recommended by Manufacturer.

C. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.

D. Install insulation on lines through clamp assembly of pipe support. Do not butt insulation up against sides of clamp assembly. Install sleeve around insulation at each clamping location to prevent crushing of insulation when clamp is tightened.

E. Stagger joints on layered insulation. Seal joints in insulation.

F. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.

G. Paint exterior exposed insulation with two coats of specified exterior finish.

END OF SECTION 15087

SECTION 15101 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Division 15010 General applies to this Section.

1.2 SCOPE:

A. Includes -
   1. General piping installation, materials and procedures for all piping systems.

B. Related Work Specified Elsewhere -
   1. Type of pipe and fittings for culinary water, drainage, etc. shall be specified in that particular Section.
   2. Hangers and supports specified in this Section are for piping not covered in Section 15070. Coordinate with Section 15070 to avoid duplication in hangers and supports.

PART 2 - PRODUCTS

2.1 HANGERS:

A. Provide one of the following types of hangers for horizontal piping. Comparable products of Grinnell, Globe Pipehanger, B-Line, Michigan Hanger, Superstrut or Piping Technology and Products (PTP) considered equal.

B. Except as otherwise specified hereinafter: Clevis type, B-Line Fig. B3100.

C. Where pipe exceeds maximum loading recommended for Clevis type Hangers, provide steel pipe clamp, B-Line Fig. B3140 or Fig. B3142, depending on loading.

D. Provide trapeze hangers where several pipes can be installed parallel and at the same level. Trapeze hangers shall consist of 2 steel channels bolted back to back spaced for rod hangers at each end. Use roller chairs B-Line B3120 pipe roll stands B-Line B3117 SL where provision for expansion is required.

E. Supporting rods shall be attached to concrete by inserts placed before concrete is poured for pipes up to 8 inches.

F. Supporting rods over 18 inches long shall be braced at every fourth hanger with diagonal bracing attached to slab or beam.

G. Spring hangers shall be used for support of pipe within 100 diameters distance of coils, or pumps, as needed to isolate vibration. Springs shall be sized 1" static deflection. Vibrex type HXAP-PC adjustable spring hangers.

H. For copper tubing use copper hanger; or dielectrically isolate.

2.2 FLOOR SUPPORTS:

A. Provide one of the following means of supporting horizontal piping from floor:

B. Pipe Saddle Support, B-Line, Fig. B3095 with pipe nipples to suit. Fasten to floor.

C. Where provision for expansion are required, pipe-roll stands, B-Line Fig. B3120 without vertical adjustment, B-Line Fig. B3122 with vertical adjustment as required. Provide concrete piers, fasten stands to piers.

2.3 WALL SUPPORTS:

A. Provide one of the following means of supporting horizontal piping from wall:
B. B-Line B-200 pipe clamp.
C. For hanger suspension, 750 pound maximum loading, light welded steel bracket with hole for one rod, 3/4 inch diameter. B-Line Fig. B3068.
D. For pipe roll stand support, welded-steel bracket, light for 700 pound maximum loading, B-Line Fig. B3063, medium for 1500 pound maximum loading Fig. B, heavy for 3000 pound maximum loading Fig. B3067.

2.4 VERTICAL PIPING SUPPORTS:

A. Vertical pipe supports shall be steel extension pipe clamps, B-Line Fig. B3373 or Fig. B3131, refer to manufacturer's rated maximum loading for each size pipe. Bolt clamp securely to pipe, rest clamp-end extension on building structure.
B. Where pipe sleeves extend above floor, place pipe clamps at ceiling below, support clamp-end extension from inserts.

2.5 CLAMPS:

A. Beam clamps shall be malleable iron, B-Line Fig. B442 for 1/4 inch hanger rods; forged steel beam clamp, B-Line B321 for hanger rod up to 1-1/2 inches.

2.6 PIPE COVERING PROTECTION:

A. Provide calcium silicate blocks in the bottom 1/2 diameter of pipe to protect insulation at areas of contact with hangers and supports. Material shall be 8 inches long for pipes up to 3 inches and 12 inches long for pipes 3-1/2 inches and larger. Insulation manufacturer supplied inserts shall be acceptable.

2.7 WALL AND CEILING PLATES:

A. Fit pipes passing through walls, floors, and ceiling with wall plates of proper size to cover openings around pipes. Plates will not be required at floor slabs where sleeves project above floor and space between pipe and sleeve is caulked and sealed. Plates shall be equal to Beaton and Cadwell No. 10, pressed steel plates. Floor plates shall be chromium plated. Wall and ceiling plates shall be prime coated.

2.8 UNIONS AND COUPLINGS:

A. Unions: Malleable iron, brass to iron seat, ground joint, same materials as pipe. Crane, Walworth, or approved equal.
B. Dielectric Unions: Mechanical Contractor shall install dielectric union or couplings whenever copper pipe connects to steel pipe or other items of

equipment. Couplings and unions shall be as manufactured by the Water Vallot Company of Detroit, Michigan, or approved equal.

2.9 PIPING SPECIALTIES:

A. Provide thermometers, pressure gages, and other miscellaneous piping specialties as shown or as may be required by usual good practices for a complete system.
B. Thermometers shall be 9" scale, red reading, glass covered, immersion type with separable sockets. Marshall-Town, Moeller, Trerice, Weskler, or Weiss, with neck extension to accommodate insulation.
C. Pressure gages shall be 4-1/2" diameter dial, molded case dust proof, phosphor bronze, bourdon tube type installed with integral check screw or pressure snubber. Marshalltown 224, U.S., Ashcroft, Trerice or Marsh.

2.10 STRAINERS:

A. Walworth 3699 - 1/2 Sarco SB; bronze, smaller than 2-1/2 inches. Bailey 125 pound No. 100; Zurn 125 pound No. 540 FPS; or Crane No. 989-1/2, cast iron 2-1/2 inches and larger. Water straining element shall be perforated 20 mesh monel screen. Strainers shall be designed for the same working pressure as the control valves. Provide strainer blowoff port with line size hose bibb and vacuum breakers.

2.11 VALVES:

A. Provide on each valve a name plate showing manufacturer, valve size, grade, and pressure temperature service rating.
B. See specific piping system sections for valves to be used in that system.

PART 3 - EXECUTION

3. 1 INSTALLATION

A. Furnish and install a complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
B. Properly support piping and make adequate provision for expansion, contraction, slope, and anchorage.
   1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
   2. Do not use pipe hooks, chains, or perforated metal for pipe support.
   3. Remove burr and cutting slag from pipes.
C. Piping shall not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

D. Make connections of dissimilar metals with insulating couplings.

E. Provide sleeves around pipes passing through floors, walls, partitions, or structural members in areas of new construction.
   1. Seal sleeves with plastic or other acceptable material.
   2. All piping passing through floors and outside walls and foundations shall have a water tight sleeve and water tight caulking around pipe. Extend pipe sleeve minimum of 3 inch above floor.

F. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of systems. Do not use plugs of rags, wool, cotton waste, or similar materials.

G. Install piping systems so they may be easily drained.

H. Do not place water piping within building perimeter in contact with earth.

I. Valves of same type shall be of same Manufacturer.

J. Do not use reducing bushings, street elbows, or close nipples.

K. Make changes in direction with proper fittings. Bending of pipe is not approved.

L. Hanger rods shall be of a diameter adequate to support pipe size.

M. Install additional supports as required.

N. Suspend all piping in building except that underground. Laying of piping on any building member is not allowed.

O. Design all hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to General Requirements specified in sub-paragraph.

P. Horizontal Piping Support Schedule: Support horizontal piping of steel, cast iron, plastic, and copper as follows:

HORIZONTAL PIPING SUPPORT SCHEDULE

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4"	3/8"	8'-0"
1-1/2" and 2"	3/8"	10'-0"
2-1/2" and 3"	1/2"	10'-0"
4" and up	5/8"	12'-0"

Q. Piping with nonpressure type joints such as Soil and Waste Piping shall be supported with a minimum of two hangers per pipe section.

R. Support horizontal lines of copper tubing with hangers. Space not more than 8 feet center to center.

S. Support Thermal Plastic Piping at 48 inches on center maximum.
   1. Provide for expansion of thermoplastic pipe in every 30 feet of straight run.
   2. Provide 12 inch offset below roofline in each vent line penetrating roof

T. Cutting or other weakening of the building structure to facilitate installation will

not be permitted. The Contractor shall demonstrate that no weight or stress is placed upon the equipment by the piping and that piping and connection of equipment are in perfect alignment. When so directed, disconnection and reconnection of piping shall be done by Contractor for designated pipe section to properly demonstrate stress; this shall be at no cost to Owner.

U. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to insure noiseless circulation. All valves and specialties shall be placed, packed and adjusted at the completion of the work before final acceptance.

V. Operating Valves shall be accessible for operation from floors or platforms where feasible, and handwheels shall not be more than 4'-6" above the floor or platform. In other cases, valves and cocks shall be equipped with chain operated handwheels or extension stems, or other suitable means of remote control.

   1. Tighten glands and add additional gland packing as required before final inspection.

W. Provide sufficient clearance for insulated piping and fittings to permit application of insulation without cutting either pipe line covering or fitting coverings.

3.2 PIPE PROTECTION:

A. Do not run piping in outside wall, or where freezing may occur. Piping in attic spaces shall be run on the interior side of building insulation.

B. No water piping in building shall be in contact with earth.

C. All piping as installed shall be plugged or capped until equipment has been permanently connected.

3.3 GRADE AND DRAINAGE:

A. All piping shall be erected to insure proper draining. Grade soil, waste, and drainage lines not less than 1/4" per foot unless noted otherwise on drawings. Grade rain water lines minimum 1/8" per foot.

B. Heating water, chilled water, condenser water and domestic hot and cold water lines shall be graded so as to drain system with as few drains as possible. Drains shall be located in convenient and accessible places. All drainage piping shall extend to floor drains.

C. Provide hose bibbs for drainage at all low points of water systems and air vents at all high points. Provide a vacuum breaker at each hose bibb.

3.4 CROSS CONNECTIONS:

A. No plumbing fixture, device or piping shall be installed which will provide a cross-connection or interconnection between a distributing water supply for drinking or domestic purposes and polluted source.

B. Provide all hose bibbs and other vent or drain valves equipped with a hose connection with a vacuum breaker.

3.5 FLEXIBLE CONNECTIONS:

A. Shall be provided wherever pipe connects to motor operated equipment.

3.6 DIELECTRIC FITTINGS:

A. Shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

3.7 PIPE JOINTING:

A. All steel pipe shall be joined by flanged, or screwed connections or by welding. Where welding is employed, welding type fittings with beveled ends shall be used. The mitering of pipes to form elbows and the notching of straight runs to form tees will not be allowed. All galvanized pipe shall be screwed. Copper pipe shall be soldered. All piping shall be cut to length by hack-saw or pipe cutter. Cutting of pipe with a torch will not be allowed.

B. Threaded Piping:
   1. Threading shall be American-Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Limit number of threads so that not more than two (2) threads will show beyond fitting.
   2. All pipe joints shall be properly sealed with thread coatings applied to the male thread. Sealer for culinary water piping shall be Teflon tape. Sealer for steel pipe in heating, waste and vent lines shall be powdered graphite and Linseed oil or plumage and linseed oil or "Type-Unyte", or Teflon tape.

C. Soldered Piping:
   1. Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for sweated fittings shall be made with a non-corrosive paste flux and solid wire solder. Use 95-5 or 96-4 Tin-Antimony solder. Cored solder will not be permitted.

D. Welding:
   1. Welders shall be certified-
      a) Welders shall be certified and shall bear evidence of certification within 30 days prior to commencing work on this project.
      b) If there is any doubt as to the proficiency of the welder, the Owner may require the welder to take another test. This shall be done at no additional expense to the Owner.
      c) Welders shall be certified in accordance with section IX of the ASME Boiler and Pressure Vessel Code by Pittsburgh Testing Laboratories or other Testing Agency acceptable to the Owner.
   2. Piping 2" and larger, and gas piping over 5 psi except plastic underground piping shall be welded. Welding shall be done using either gas or electric welding equipment. No electric welding shall be done when the atmospheric temperature is below 40 degrees F. without first preheating the ends of the pipe. Thoroughly clean all piping surfaces before welding. The width of circumferential welds shall be 2-1/2 times the wall thickness of the pipe. Piping shall be securely aligned and spaced. The deposited metal shall form a gradual increase in thickness

from the outside surface to the center of the weld. Make welds in at least two beads. Each shall be cleaned using stiff wire brushes or pointed descaling tools. The final beads shall be similarly cleaned for inspection.

3. Fittings -
   a) All fittings shall be ASA Standard fittings and shall be of standard pipe thickness.
   b) All elbows shall be long radius.
   c) Wherever tee connections are made to piping systems on the main run, welding sockets shall be installed for the branch connections up to one half the size of the main run, welding tees shall be used.
   d) The use of fittings formed from welded pipe sections and or notching of pipe will not be permitted. Changes in pipe size shall be made with tapered fittings.
   e) Connection to equipment shall be flanged using std 150 psi weld neck flanges or flanges rated for pressure of system encountered. Gaskets shall be non-asbestos type of material suitable for temperature, pressure and substance in system.
   f) All welding fittings used in welding system shall be manufactured by Tube Turns Inc., Taylor Forge and Pipe Works, Midwest Piping and Supply Co., or Bonney Forge and Tool Works, for “Weld-O-Lot” or Thread-O-Lot”, or approved equal fittings and shall match the pipe in which they are installed.
4. Safety precautions -
   a) The contractor shall provide a fire proof mat or blanket to protect the structure, and adequate fie protection at all locations where welding is done.
5. Testing and acceptance -
   a) Engineer and Owners Representative shall at their disgression shall inspect welds. If welds are found to be suspect, contractor shall provide testing of questionable welds at contractors expense.
   b) Testing shall be by radiograph, ultrasonic, sectioning or a combination of these methods at the option of the Owner.
   c) The contractor shall test a minimum of 6 welds up to a maximum of 1/4 of all welds on project as selected by Engineer.
   d) Tests shall be preformed by a recognized independent testing agency acceptable to all parties. Agency shall submit a test report.
   e) If defective joints are discovered Owner shall have right to require all welds removed and redone or remaining welds tested and all defective welds replaced. All work to test, remove and replace welds shall be at contractors expense.

3.8 FLASHINGS:

A. Wherever roof is pierced by work installed by this Contractor, he shall furnish proper flashings to be installed by the Roofing Contractor. All piercings of roof shall be sealed air and water tight.

B. Provide proper flashings, counter flashings, metal collars or other work as required to make weather tight seal at all fan connections, duct piercings, etc., as shown and/or required for work installed under this Contract.

C. 16 oz sheet copper flashings may be used in lieu of lead. Flashing shall be fitted snugly around pipe. Caulk between flashing and pipe to seal. Make water and air tight using a flexible waterproof compound. Base shall be 24" square.

D. Roof drains shall have a 36"x36" lead pan.

3.9 PIPE CLEANING AND DISINFECTION:

A. All piping shall be flushed clean before connection to equipment. Domestic water lines shall be thoroughly flushed out with an alkaline detergent solution to remove pipe dope, oil, loose mill scale, and other extraneous materials.

B. After the water system has been flushed clean, the shutoff valve to the water main shall be closed. All fixture outlets shall be opened slightly. A solution of sodium hypochlorite and clean water shall be introduced at the new tie-in to the existing water pipes downstream of new valve, until residual chlorine is detected at all water faucets, outlets, etc. The solution shall consist of 1 gallon of 5 percent sodium hypochlorite (Chlorox or Purex) to 200 gallons of water. The solution shall be flushed and all aerators and strainers shall be removed, cleaned and replaced. Care shall be taken to not allow solution to enter existing piping.

C. Contractor shall furnish to Owner and Architect a written report certifying completion that pipe cleaning and disinfection has been completed and accepted.

3.10 PIPE TESTING:

A. Test all piping prior to painting, insulating, backfilling or other concealment. Valve off or isolate controls, fittings, equipment or other piping which may be damaged by testing pressures. Provide relief valves set to avoid bursting pressure during test.

B. Soil, waste and vent systems shall be filled to roof level with water and show no leaks over a 24 hour period.

C. Domestic water piping shall be hydrostatically tested at 100 psi with less than a four percent drop in pressure over a six hour period.

D. Natural gas piping see Section 15192.

END OF SECTION 15101

SECTION 15140 - HOT AND COLD WATER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Furnish and install all culinary hot and cold water piping shown on the drawings complete with necessary valves, connections, and accessories inside the building and connect into cold water service piping where shown on the drawings.
   2. All water systems shall meet the requirements of ANSI/NSF Standard 61 Section 9 (1998), concerning metal contaminants in the water system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Inside Building
   1. Hot and cold water service piping: Type L, copper, hard drawn with wrought copper fittings.
B. Outside the building
   1. Type K copper with brazed joints.
   2. Join pipe with brazed joints where allowed by authority having jurisdiction.

2.2 VALVES:

A. Interior culinary water valves shall be ball type.
   1. Con Bra Co “Apollo”
   2. Hammond
   3. Honeywell - Braukmann
   4. Jenkins
   5. Milwaukee
   6. Nibco - Scott
   7. Stockham
   8. Watts
B. Combination pressure reducing valve and strainer.
   1. Provide on main water line at entrance to building.
   2. Integral stainless steel strainer or separate "Y" strainer installed up stream of pressure reducing valve.
   3. Built-in thermal expansion by-pass check valve.
   4. Approved manufacturers.
      a) Watts U5B or equal by
      b) Cash valve
      c) Clayton valve
      d) Spencer
      e) Thrush
      f) Wilkins

2.3 VACUUM BREAKERS AND BACKFLOW PREVENTERS:

A. Backflow preventers and vacuum breakers shall be installed in water lines to provide protection against cross contamination. Such devices shall be of approved manufacture and installed in accordance with the Uniform Plumbing Code. Provide backflow preventers for:
   1. Hose bibbs
   2. Any fixture that accommodates a hose or tubing connection (i.e. faucets, etc.)
   3. Make-up water lines to mechanical equipment
   4. Any item required by code to have same

B. Backflow preventers, vacuum breakers and completed assembly shall comply with the International Plumbing Code.

2.4 HYDRAULIC SHOCK (WATER HAMMER) CONTROLS:

A. Provide hydraulic shock controls for flush valves and water header. Shock controls shall be Smith, Zurn, Wade, or Josam.

2.5 DOMESTIC HOT WATER CIRCULATING PUMP:

A. Furnish and install the In-Line Circulating Pump scheduled on the plans.
B. The pump shall be of the horizontal oil lubricated type specifically designed and guaranteed for quiet operation. Suitable for 125 psig working pressure.
C. The pump shall have a ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two horizontal sleeve bearings designed to circulate oil. The pump shall be equipped with a water-tight seal to prevent leakage. Mechanical seal faces shall be to be carbon on ceramic.
D. The motor shall be non-overloading at any point on pump curve.
E. The motor shall be of the open, drip-proof sleeve-bearing, quiet-operating, rubber-mounted construction. Motor shall have built-in thermal overload protectors.
F. The pump shall be bronze suitable for pumping culinary water.
G. Approved Manufacturer -
   1. Bell and Gossett
   2. Grund Fos
   3. Armstrong

PART 3 - EXECUTION

3.1 INSTALLATION

A. For general piping installation, see Section 15101**.**
B. Piping Inside of Building
   1. Provide valves on hot and cold water lines to rest rooms and kitchen for zone control of system. Provide access for all valves.
   2. Do not run piping in outside walls or ceiling space unless it is located on

the building side of insulation envelope.

3. Locate cold water piping a minimum of six inches from hot water piping.
4. Before pipes are covered, buried, etc. Contractor shall test the piping installation in the presence of the Architect, and Owners Representative. Piping shall be tested as described in Section 15101.

C. Pipe Sterilization and Disinfection

1. Sterilize the new domestic water system as described in Section 15101, paragraph I.
2. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.
3. Water system will not be accepted until a negative bacteriological test is made on water taken from system. Chlorine dosing shall be repeated as necessary until such negative test is accomplished. Submit written report of test to Architect and Owner for their approval.
4. When connecting into existing water lines, Contractor shall properly protect and cap the existing piping or Contractor shall stand the cost of cleaning and disinfecting the existing piping system to Owner's satisfaction.

END OF SECTION 15140

SECTION 15150 - SOIL, WASTE AND VENT PIPING SYSTEM

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Furnish and install all soil, waste, and vent piping systems as shown on the drawings.
B. Related Work Specified Elsewhere -
   1. Roof drains specified in Section 15410.
C. Coordination
   1. Coordination with Division 02 for tie-ins to site work.

1.2 REFERENCES:

A. American Society For Testing And Materials
   1. ASTM D 2235-96a, ‘Standard Specification for Solvent Cement for ABS Plastic Pipe and Fittings’
   2. ASTM D 2321-89, ‘Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications’
   3. ASTM F 628-97, ‘Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings with a Cellular Core’

PART 2 - PRODUCTS

2.1 SOIL AND WASTE PIPING

A. ABS Piping and Fittings
   1. Buried Piping
      a) Minimum size of waste piping installed under floor slab on grade shall be 2 inches.
      b) Approved Type -
         1) ABS Schedule 40 cellular core plastic pipe meeting requirements of ASTM F 628 joined with pipe cement meeting requirements of ASTM 2235.
   2. Above Grade Piping And Vent Lines
      a) Approved Type -
         1) ABS Schedule 40 cellular core plastic pipe meeting requirements of ASTM F 628 joined with pipe cement meeting requirements of ASTM 2235.
   3. Fittings - ABS Schedule 40 cellular core plastic pipe fittings meeting requirements of ASTM F 628 joined with pipe cement meeting requirements of ASTM 2235.
B. Provide concrete grease interceptor per requirements of South Valley Water Reclamation District. See drawings for size and details.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For general piping installation requirements, see Section 15101.

B. ALL PIPING:

1. Excavation and backfill shall be as specified in Division 02 with the following additional requirements.
   - a) Runs shall be as close as possible to those shown on drawings.
   - b) Excavate to required depth.
   - c) Grade to obtain fall required. Piping shall be laid on compacted sand, true to line and grade - blocking not allowed.
   - d) Bottom of trenches shall be hard. Tamp as required.
   - e) Remove debris from trench prior to laying of pipe.
   - f) Do not cut trenches near footings without consulting Architect.
   - g) Bury outside pipe 12 inches minimum below frost line or 18 inches minimum below finish grade, whichever is deeper.
2. Regulatory Requirements
   - a) Install clean outs in accordance with local governing authority and State codes.
3. Performance Requirements
   - a) Failure to install joints properly shall be cause for rejection and replacement of piping system.
4. Remove excess earth from site or place as directed by Architect.

C. Thermoplastic Pipe And Fittings

1. General - Piping and joints shall be clean and installed according to Manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
2. Above Grade - Locate pipe hangers every 4 feet on center maximum and at elbows.
3. Below Grade -
   - a) Install in accordance with Manufacturer's recommendations and ASTM D 2321.
   - b) Stabilize unstable trench bottoms.
   - c) Bed pipe true to line and grade with continuous support from firm base.
     - 1) Bedding depth - 4 to 6 inches.
     - 2) Material and compaction to meet ASTM standard noted above.
   - d) Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
   - e) Trench width at top of pipe -
     - 1) Minimum - 18 inches or diameter of pipe plus one foot, whichever is greater.
     - 2) Maximum - Outside diameter of pipe plus two feet.
   - f) Do not use back hoe or power equipment to assemble pipe.
   - g) Initial backfill shall be 12 inches above top of pipe with material specified in referenced ASTM standard.
   - h) Minimum cover over top of pipe not under building slab -
     - 1) 36 inches before wheel loading.

2) 48 inches before compaction.

D. PLACE CLEAN OUTS:
   1. Where shown on Drawings and at base of each stack and riser.
   2. At every 90 degree change of direction for horizontal line.
   3. Every 50 feet of straight horizontal run.
   4. Extend clean out to accessible surface. Do not place clean outs in carpeted floors. In such locations, use wall type clean outs.
   5. Clean outs in piping outside building shall be extended to grade with adequate covers for planted or concrete areas.
   6. Clean outs on rainwater lines shall be the same as sewer lines.
   7. Provide clean out at connection of building piping to outside utility piping at 5'-0" outside of building.

E. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a P-trap in connection with a complete venting system so gasses pass freely to atmosphere with no pressure or syphon condition on water seal. Clean outs and plugs shall not be provided on P-traps.

F. Before piping is covered, Contractor shall test the piping installation in the presence of Architect, and Owners Representative, and correct leaks or defective work. Do not caulk threaded work.
   1. Thermoplastic Pipe System
      a) Before backfilling and compacting of trenches, cap all ends and pressure test by filling waste and vent system to roof level with water, 10 ft minimum and show no leaks for two hours. Correct leaks and defective work.
      b) After backfilling and compacting of trenches is complete but before patching floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

G. Vent entire waste system to atmosphere. Discharge vent piping 14 inches above roof. Join lines together in fewest practical number before projecting through roof. Locate vent lines so they will not pierce roof near an edge or valley.

H. Use torque wrench to obtain proper tension in cinch bands (above ground) when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

I. Flash pipes passing through roof in accordance with the requirements of Section 15101.

J. Install grease interceptor per requirements of South Valley Water Reclamation District, and all other applicable codes.

END OF SECTION 15150

SECTION 15181 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install condensate drain piping as described in Contract Documents.

B. Related Sections
   1. Section 15051 - General Mechanical Requirements

PART 2 - PRODUCTS

2.1 MATERIALS

A. Condensate Drains
   1. Schedule 40 PVC for condensate drains from furnace combustion chambers and furnace cooling coils.
   2. 3 inch deep seal, vented water trap adjacent to cooling coil connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains
   1. Support piping and protect from damage.
   2. Do not combine PVC condensate drain piping from furnace combustion chamber with condensate drain piping from cooling coil.

END OF SECTION 15181

SECTION 15184 - REFRIGERANT PIPING & SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.
B. Related Sections
   1. Section 15084 - Refrigerant Piping Insulation

1.2 REFERENCES

A. American National Standards Institute / American Welding Society
   1. ANSI / AWS A5.8-92, 'Standard Specification for Brazing Alloys'
B. American Society For Testing And Materials
   1. ASTM A 36-97a, 'Standard Specification for Carbon Structural Steel'
   2. ASTM A 361-94, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding'
   3. ASTM B 280-98, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'

1.3 SUBMITTALS

A. Shop Drawings - Show each individual equipment and piping support
B. Quality Assurance / Control - Technician certificate for use of CFC and HCFC refrigerants

1.4 QUALITY ASSURANCE

A. Qualifications - Refrigerant piping shall be installed by a refrigeration contractor licensed by State and by technicians certified in use of CFC and HCFC refrigerants.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Refrigerant Piping
   1. Meet requirements of ASTM B 280, hard drawn straight lengths. Soft copper tubing not permitted.
   2. Do not use pre-charged refrigerant lines.
B. Refrigerant Fittings
   1. Wrought copper with long radius elbows.
   2. Approved Manufacturers -
      a) Mueller Streamline
      b) Nibco Inc

c) Grinnell
d) Elkhart

C. Suction Line Traps
1. Manufactured standard one-piece traps.
2. Approved Manufacturers -
a) Mueller Streamline
b) Nibco Inc
c) Grinnell
d) Elkhart

D. Connection Material
1. Brazing Rods in accordance with ANSI / AWS A5.8 -
a) Copper to Copper Connections -
1) Classification BCuP-4 Copper Phosphorus (6 percent silver).
2) Classification BCuP-5 Copper Phosphorus (15 percent silver).
b) Copper to Brass or Copper to Steel Connections - Classification BAg-5 Silver (45 percent silver).
c) Do not use rods containing Cadmium.
2. Flux -
a) Approved Manufacturers -
1) Stay-Silv White Brazing Flux by J W Harris Co
2) High quality silver solder flux by Handy & Harmon

E. Valves
1. Expansion Valves -
a) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
b) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
c) Approved Manufacturers -
1) Alco
2) Henry
3) Mueller
4) Parker
5) Sporlan
2. Manual Refrigerant Shut-Off Valves -
a) Ball valves designed for refrigeration service and full line size.
b) Valve shall have cap seals.
c) Valves with hand wheels are not acceptable.
d) Provide service valve on each liquid and suction line at compressor.
e) If service valves come as integral part of condensing unit, additional service valves shall not be required.
f) Approved Manufacturers -
1) Henry
2) Mueller
3) Superior
4) Virginia

F. Filter-Drier
   1. On lines 3/4 inch outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
   2. On lines smaller than 3/4 inch outside diameter, filter-drier shall be sealed type using flared copper fittings.
   3. Size shall be full line size.
   4. Approved Manufacturers -
      a) Alco
      b) Mueller
      c) Parker
      d) Sporlan
      e) Virginia

G. Sight Glass
   1. Combination moisture and liquid indicator with protection cap.
   2. Sight glass shall be full line size.
   3. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
   4. Approved Manufacturer -
      a) Alco AMI

H. Flexible Connectors
   1. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
   2. Approved Manufacturers -
      a) Anaconda 'Vibration Eliminators' by Anamet
      b) Vibration Absorber Model VAF by Packless Industries
      c) Vibration Absorbers by Superior Valve Co
      d) Style 'BF' Spring-flex freon connectors by Vibration Mountings

2.2 MATERIALS

A. Refrigerant Piping Supports
   1. Base, Angles, And Uprights - Steel meeting requirements of ASTM A 36.
   2. Securing Channels -
      a) At Free-Standing Pipe Support -
         1) Acceptable Manufacturers And Models -
            a] P-1000 Unistrut channels
            b] Hilti HS-158-12 channels
            c] Equal as approved by Architect prior to installation. See Section 01600.
      b) At Wall Support -
         1) Acceptable Manufacturers And Models -
            a] P-3300 Unistrut channels
            b] Hilti HS-1316-12 channels
            c] Equal as approved by Architect prior to installation. See Section 01600.
      c) At Suspended Support -
         1) Acceptable Manufacturers And Models -
            a] P-1001 Unistrut channels

b] Hilti MS-41 channels
c] Equal as approved by Architect prior to installation. See Section 01600.

3. Angle Fittings -
   a) Acceptable Manufacturers And Models -
      1) P-2626 90 degree Unistrut angle
      2) Hilti MW2 angle
      3) Equal as approved by Architect prior to installation. See Section 01600.
4. Pipe Clamps -
   a) Acceptable Manufacturers -
      1) Hydra-Zorb
      2) ZSI Cush-A-Clamp
      3) Hilti Cush-A-Clamp
      4) Equal as approved by Architect prior to installation. See Section 01600.
5. Protective Cover - 18 ga steel, hot-dipped galvanized to meet requirements of ASTM A 361, 1.25 oz/sq ft.

PART 3 EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines
   1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
   2. Slope suction lines down toward compressor one inch/10 feet. Locate traps at vertical rises against flow in suction lines.

B. Connections
   1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
   2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
   3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties
   1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
   2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
   3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
   4. Provide flexible connectors in each liquid line and suction line at condensing unit on systems 5 tons and small and at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each

flexible connector.

D. Refrigerant Supports
   1. Support Spacing -
      a) Piping 1-1/4 inch And Larger - 8 feet on center maximum.
      b) Piping 1-1/8 inch And Smaller - 6 feet on center maximum.
      c) Support each elbow.
   2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
   3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
   1. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
   2. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
   3. Conduct tests at 70 deg F ambient temperature minimum.
   4. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
   5. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
   6. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION 15184

SECTION 15192 NATURAL GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Perform excavation and backfill required for work of this Section.
   2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.

B. Related Sections
   1. Division 02 -
      a) Procedure and quality of excavating, backfilling, & compacting
      b) Gas line from meter to main
   2. Division 09 - Painting of exterior piping
   3. Section 15010 - General Mechanical Requirements

1.2 REFERENCES

A. American Society For Testing And Materials
   1. ASTM A 53-96, 'Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless'
   2. ASTM A 234-96b, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature Service'
   3. ASTM D 2513-96a, 'Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings'

1.3 QUALITY ASSURANCE

A. Qualifications
   1. Welders shall be certified and bear evidence of certification 30 days before commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority. See Section 15101
   2. Polyethylene pipe installers shall be properly trained and certified in procedure for joining polyethylene pipe.

1.4 DELIVERY, STORAGE, & HANDLING

A. Do not store polyethylene pipe so it is exposed to sunlight.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Valves
   1. 125 psi bronze body ball valve, UL listed
   2. Approved Manufacturers & Models -
      a) ConBraCo - 'Apollo' series 80-100
      b) Jenkins - FIG-30-A
      c) Jomar - Model T-204
      d) McDonald - 3410
      e) Milwaukee - BCI-100T (with tee handle)
      f) PGL Corp - 'Red Cap' gas ball valve
      g) Watts - Model B-6000-UL
B. Seismic Shut-Off Valve
   1. Valve to automatically shut-off gas in event of earthquake.
   2. Provide with manual reset.
   3. Approved Manufacturers
      a) Safe-T-Quake
      b) Trembler Tech
      c) Koso
      d) Prior approved equal

2.2 COMPONENTS

A. Above-Ground Pipe & Fittings - Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of ASTM A 53. Welded forged steel fittings meeting requirements of ASTM A 234 or standard weight malleable iron screwed.
B. Below-Ground Pipe & Fittings - Polyethylene pipe and fittings meeting requirements of ASTM D 2513 with No. 14 coated copper trace wire.

PART 3 EXECUTION

3.1 INSTALLATION

A. Steel pipe installed through air plenums, in walls, and pipes 2 inches and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.
B. Lay underground pipe in accordance with Manufacturer's recommendations and local gas utility company regulations and specifications.
   1. Provide 2 foot minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or compression fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
   2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
   3. Place 4 inches of sand around gas line buried underground.
   4. Do not install gas piping under building floor slabs-on-grade.
C. Install gas cocks on lines serving gas-fired equipment adjacent to equipment, on outside of equipment cabinet, and easily accessible.
D. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving

each gas-fired equipment unit.

E. Use fittings for changes of direction in pipe and for branch runouts. Use tapered fittings for changes in pipe size.

F. Install earthquake valve on downstream side of meter prior to pipe entering the building. Adjust location of pipe entering building as necessary to accommodate installation of valve per manufacturer’s recommendations.

3.2 FIELD QUALITY CONTROL

A. Site Tests - Before pipes are buried or concealed from view, test systems in Architect's presence with 3 psig air pressure for 10 minutes with no drop in pressure using a half pound increment gauge. For line pressures in excess of 4oz test at 1½ times the working pressure.

END OF SECTION 15192

SECTION 15410 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 SCOPE

A. Division 15010, 15051, and 15110 applies to this Section.

B. All sinks and lavatories shall have a shut-off valve on all water supply lines on the room side of the fixture. All valves must have a gasket seat, not a ground joint. Supply lines from the valve shall be 3/8" brass, chrome plated.

C. Interior exposed pipe, valves, and fixture trim shall be chrome plated.

D. Complete installation of each fixture including P-trap and accessories with accessible stop or control valve in each hot and cold water branch supply line.

E. Polish chrome finish at completion of Project.

F. Water closets and urinals shall have screwdriver stop valves on flush valves. Flush valves shall be of the exposed type.

G. Fixtures to be all of one type.

H. Floors shall slope to drains.

I. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point all edges.

J. Install fixtures and fittings as per local codes and Manufacturer's instructions. Fixtures shall be mounted level.

K. Do not use flexible water piping.

L. Provide fixture carriers for each fixture. Each carrier shall be of the proper type and size for fixture installed and installation location (wall or chase). Approved manufacturers are Wade, Smith, Josam, and Zurn.

M. All plumbing fixtures, trim and accessories in contact with the culinary water system shall comply with the requirements of ANSI/NSF 61 Section 9, (1998). Every box containing such component shall carry a notice of compliance including Testing Lavatory providing classification/certification and control number.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Floor Mounted Flush Valve-

1. Handicap Type.

    a. American Standard - Cadet EL 1.6, 3043.102, siphon jet elongated bowl, 1 ½ inch top spud.
    b. Kohler
    c. Eljer

2. Flush Valve - lever operated, ADA approved, model to match fixture

    a. Sloan Royal or equal by
    b. Zurn Aqua Vantage AV
    c. Coyne Delany Flush Boy

B. Seat - (Provide split front type with check hinge)

1. American Standard "Church"
2. Crane Embassy
3. Bemis
4. Kohler
5. Olsonite
6. Beneke
7. Spertzel

C. Urinals: ADA

1. Fixture - Kohler Dexter K5016-T, 1-1/2" top spud or equal by

    a. American Standard
    b. Eljer Terminal

2. Flush Valve- lever operated, ADA approved, model to march fixture, 1.0 gal flush

    a. Sloan Royal or equal by
    b. Zurn Aqua Vantage AV
    c. Coyne - Delany Flush Boy

3. Mounting heights

    a. Handicap 17 inches from floor to bottom lip.

D. Lavatories: ADA Approved

1. Self Supporting Fixture

a. Size 20" x 18" with 4" centers/arm carrier or wall mount bracket as required.

1) American Standard Lucerne - 0356.051 vitreous china
2) Kohler - Greenwhich K-2032
3) Eljer Delwyn 051-1644

2. Counter Top Fixtures -

a. Size 20 by 17 inches maximum
b. Approved Manufactures & Models -

1) American Standard - Aqualyn 0476.028
2) Eljer - Laura 051-0124
3) Kohler - Pennington K-2195

3. Fittings -
a. Faucet And Drain

1) American Standard - 5402.142H
2) Cambridge Brass - 21T143
3) Chicago - 1802A-E3-369
4) Delta - 2523 HDF
5) Eljer - 559-2010 with 803-0530 drain.
6) Kohler - K-7404-5-A with K-16010-4 lever handle and K-13885 drain.
7) Sanitary Dash - R7308
8) T & S Brass - B-8070 with B-0899 strainer

b. Supply pipes with stops -

1) Provide stuffing box and chrome plating.

a) Brass Craft - TCR 1912 A-CP
b) Zurn - 8804 LR-PC
c) Traps -

2) 17 ga tube 'P' trap, chrome plated

a) Dearborn
b) McGuire
c) Sanitary Dash

c. Safety shields Where McGuire traps are furnished, they shall be provided with factory installed insulation and covers.

d. For supply stops and all other p-traps the following kits are approved:

1) Trapwrap by Brocar Products
2) Prowrap by McGuire Products

3) Handi Lav-Guard by True Bro

E. Hand Sink

1. Self Supporting Fixture

a. Size 20" x 18" with 4" centers/arm carrier or wall mount bracket as required.

1) American Standard Lucerne 0356-007 vitreous china
2) Kohler - Greenwhich K-2032
3) Eljer Delwyn 051-1644

2. Fittings

a. Faucet And Drain -

1) American Standard - 5402.142H
2) Cambridge Brass - 21T143
3) Chicago - 1802A-E3-369
4) Delta - 2523 HDF
5) Eljer - 559-2010 with 803-0530 drain.
6) Kohler - K-7404-5-A with K-16010-4 lever handle and K-13885 drain.
7) Sanitary Dash - R7308
8) T & S Brass - B-8070 with B-0899 strainer

b. Supply pipes with stops -

1) Provide stuffing box and chrome plating.

a) Brass Craft - TCR 1912 A-CP
b) Zurn - 8804 LR-PC
c) Traps - 17 ga tube 'P' trap, chrome plated
d) Dearborn'
e) McGuire
f) Sanitary Dash

c. Safety Shields -

1) Where McGuire traps are furnished, they shall be provided with factory installed insulation and covers.
2) For supply stops and all other p-traps the following kits are approved:

a) Trapwrap by Brocar Products
b) Prowrap by McGuire Products
c) Handi Lav-Guard by True Bro

F. Hand Sink Stainless Steel ADA Compliant
1. Self Supporting Fixture

a. Size 22x19 18 ga. type 304 stainless steel 3-holes on 2" centers and overflow.
b. Approved Manufactuers

1) Elkay ELV-2219CS
2) Equal by Just, Western, Acorn or Prior approved equal.

2. Fittings

a. Faucet And Drain -

1) American Standard - 5402.142H
2) Cambridge Brass - 21T143
3) Chicago - 1802A-E3-369
4) Delta - 2523 HDF
5) Eljer - 559-2010 with 803-0530 drain.
6) Kohler - K-7404-5-A with K-16010 lever handle and K-13885 drain.
7) Sanitary Dash - R7308
8) T & S Brass - B-8070 with B-0899 strainer

b. Supply pipes with stops -

1) Provide stuffing box and chrome plating.
2) Brass Craft - TCR 1912 A-CP
3) Zurn - 8804 LR-PC
4) Traps - 17 ga tube 'P' trap, chrome plated

a) Dearborn
b) McGuire
c) Sanitary Dash

c. Safety Shields -

1) Where McGuire traps are furnished, they shall be provided with factory installed insulation and covers.
2) For supply stops and all other p-traps the following kits are approved:
3) Trapwrap by Brocar Products

a) Prowrap by McGuire Products
b) Handi Lav-Guard by True Bro

G. Floor Drains

1. With chrome plated strainer and deep seal p-trap.

a. Wade 1100 with 2450-t trap with trap primer connection or equal by Josam, Smith or Zurn

H. Hose Bibb-

1. With vacuum breaker and loose key handle
2. Woodford Model 24P Polish Chrome finish or equal by
3. Chicago (Polish Chrome Finish)
4. Hammond (Brass Finish)

I. Floor Sink

1. 8 inch square top, medium receptor cast iron body with flanged receptor, acid resistant coated interior, and acid resistant coated half grate. Aluminum sediment bucket and 2 inch caulked regular outlet connection and deep seal P-Trap with trap primer connection.
2. Approved Manufacturers:

    a. Smith 3411
    b. Josam 49002
    c. Wade W9112
    d. Zurn 1915

J. Cleanouts:

1. Approved Types -

    a. Finish Floors - Wade W6000, Zurn A-1420-2, Smith 4023-T
    b. Resilient Flooring - Wade W6000-T, Zurn Z-1400-6, Smith 4140
    c. Finished Wall - Wade W8460-R-5, Zurn Z-1445-1, Smith 4530
    d. Exposed Drain Lines - Wade W8560A, Zurn Z-1440-A, Smith 4515
    e. General Purpose - Wade W8550A, Zurn Z-1440-a, Smith 4405

K. Kitchen Sink

1. 14 gauge type 304 nickel bearing stainless steel scullary sink. Compartments 14" deep welded 1/4" radius coved corner construction. Welds shall be ground to a smooth and cleanable finish. Provide with full length 8" high back splash with 45 degree sloped top 1 ½" wide inward sloping top channel rims. Integral drainboards, sink compartments pitched to drain. Exposed surfaces polished to a satin finish. Sin kshall carry the NSF International Certification.

    a. Sink shall be supported on 4 stainless steel, 1 5/8" tubular legs, #16 gauge wall thickness. Adjustable bullet shaped feet up to 1".
    b. Approved Manufacturers and Model

        1) Elkay WNSF-8372-LR overall dimensions 120" long 27 ½" wide. Bowl dimensions 24"X24"x14" deep. Drilled for two faucets on 8" centers in standard backsplash location.

2. Provide and install on kitchen sink 2- Zurn Z-8421 kitchen sink faucets with 8" centers. Faucet shall be chrome plated brass, standard lever handles and chrome plated brass swing spout with flow control spout

strainer with max 3.0 gpm and be ADA designated. Equal faucets by Elkay, Kohler or Eljer are acceptable.

3. Sink drain shall be a lever operated drain outlet fitting for 3 ½" opening, 4 1/8" OD top stainless steel flange with brass body, stainless steel perforated grid, chrome plated brass 1 ½" OD 4" tail piece and stainless steel lever arm 2 required. Elkay LK-24RT and LK 52 continuous waste drain connections.
4. Supply kit shall include chrome plated brass stops with brass stems, chrome plated copper risers, and flange (Loose key handles). Inlet shall be sweat type. Outlet shall be compression. Supply kit shall be certified by CSA or other recognized testing authority. Stop shall bear manufacturer and testing mark. Approved manufacturers: McGuire, Kohler, or American Standard.
5. Sink P-Traps shall have heavy gauge cast brass body without cleanout plug, cast brass nuts, 17 ga. Seamless brass wall bend and steel flange. All traps shall have a minimum 2" water seal. Finish to be copper nickel chrome plate. Product shall be visibly marked with manufacturers name. Approved Manufacturers: McGuire, Kohler or American Standard.

L. Service Sink

1. Fixture -

   a. Floor type 24 by 24 inches terazzo or molded stone with stainless steel rim guard.
   b. Aproved Manufacturers & Models -

      1) Sterns Williams
      2) Fiat
      3) Prior approved equal

2. Fittings -

   a. Supply
   b. Mounting height of 42 inches
   c. Provide 48 inch hose and clamp.
   d. Approved Manufacturers & Models -

      1) American Standard - 8344.111 with threaded spout
      2) Eljer - 749-1450
      3) Kohler - K-8928
      4) Speakman - SC-5811 RCP-5H

   e. Drain & Strainer -
   f. Approved Manufacturers & Models -

      1) American Standard - 7721.038
      2) Eljer - 803-0630
      3) Kohler - K-9146, 3 inch IPS.
      4) Trap - Cast iron

M. Supply-Type, Trap-Seal Primer Valves:

1. MIFAB, Inc.

    a. PPP Inc.
    b. Sioux Chief Manufacturing Company, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts Industries, Inc.; Water Products Div.
    e. Prior approved equal

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

N. Drainage-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    b. prior approved equal

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.
3. Size: NPS 1-1/4 (DN 32) minimum.
4. Material: Chrome-plated, cast brass.

O. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. PPP Inc.
    b. Prior approved equal

2. Standard: ASSE 1044,
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: [Recessed] [Surface]-mounting steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: [Four] [Six] [Eight] <Insert number>.
8. Size Outlets: [NPS 1/2] [NPS 5/8].

P. Mixing valve

1. Valve shall be thermostatic and pressure mixing valve with maximum 5 degree approach temperature.
2. Provide a mixing valve at each handsink and lavatory.
3. Approved Manufacturers -

    a. Powers hydroguard TP or equal by
    b. Sloan
    c. Prior approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install complete system in accordance with plumbing code.

END OF SECTION 15410

SECTION 15481 - GAS-FIRED WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install gas-fired storage type water heater as described in Contract Documents.

B. Related Sections
   1. Section 15051 - General Mechanical Requirements
   2. Section 15140 - Potable Water Piping System
   3. Section 15557 - Air Piping

1.2 WARRANTY

A. 3 years on tank and one year for parts.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Condensing Type Water Heaters
   1. Stainless steel or 90/10 cupronickel heat exchanger, pressure tested and rated for 150 psi w.p. complete with thermostat, high limit control, gas pressure regulator, 100 percent safety shutoff and powered combustion air blower. AGA and CGA approved.
   2. 94 percent thermal efficiency
   3. Temperature and pressure relief valve sized to match heat input and set to relieve at 120 psi.
   4. 80 - 100 Gallon -
      a. Approved Products -
         1) Cyclone-XHE Model BTH-199 by A. O. Smith
         2) Advantage Plus HE8O-199 by Rheem-Ruud
         3) Voyager SSV-199-80R by Heat Transfer Products

2.2 ACCESSORIES

A. Anchoring Components
   1. Anchoring stand by Quake-safe, Watts or prior approved equal.

B. Thermal Expansion Absorbers
   1. Bladder type for use with potable water systems.
   2. Acceptable Products -
      a. Therm-X-Trol ST-12 by Amtrol or equal by
      b. Watts

c. Bell and Gossett

PART 3 EXECUTION

3.1 INSTALLATION

A. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor drain.

B. Anchor water heaters to wall using anchoring components as specified.

END OF SECTION

SECTION 15532- GAS-FIRED FURNACES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install gas fired condensing furnaces as described in Contract Documents.

B. Related Sections
   1. Section 15055 - General Mechanical Requirements
   2. Section 15196 - Natural Gas Piping
   3. Section 15861 - Air Filters

1.2 SYSTEM DESCRIPTION

A. Performance Requirements - Rated at 90 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.

1.3 SUBMITTALS

A. Quality Assurance / Control - Equipment check-out sheets

1.4 WARRANTY

A. Provide 15 year minimum limited warranty on heat exchanger.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Furnaces
   1. Factory assembled units certified by AGA complete with blower section, vertical flow furnace section, steel casing, piped, and wired.
   2. Blower section shall consist of cabinet, variable speed blower, and motor.
      a) Cabinet shall be of 22 gauge minimum cold rolled steel and have finish coat of baked-on enamel.
      b) Blower shall be Class 1, full DIDW, statically and dynamically balanced, with variable speed control.
   3. Provide furnace with accessory side mounted filter box frame and factory available bottom closure, or bottom filter with clamps, or both, as detailed.
   4. Automatic controls shall consist of -
      a) 100 percent cut-off safety pilot.
      b) Manual gas shut-off valve.
      c) Operating automatic gas valve.
      d) Solid state type fan and thermal limit controls.
      e) 24 volt transformer.

f) Electronic ignition system.

5. Blower shall be driven by motor with adjustable pitch V-belt drive or by a multi-speed direct driven motor.
6. Furnace section shall be enclosed in 22 gauge minimum enameled steel casing lined with foil covered insulation.
7. Heat Exchanger - Aluminized steel.
8. Gas Burners - Aluminized steel.
9. PVC intake of outside air and PVC combustion product exhaust, with sealed combustion, direct vent, system.
10. Concentric roof termination kit for roof mounting.
11. Approved Manufacturers & Models -
    a) Carrier 58MVP or equal by
    b) Trane
    c) York

B. Cooling Coil
1. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match furnace.
2. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match furnace or heavy gauge embossed, galvanized steel cabinet with no finish.
    a) Coil shall have aluminum fins bonded to seamless copper tubing.
    b) Coil shall be ARI rated. Provide drain pans with connections at one end.
    c) Use thermal expansion valve in place of capillary tube metering device.
3. Approved Manufacturers
    a) Carrier
    b) Trane
    c) York

2.2 ACCESSORIES

A. Air return filter kit and assembly mounted external to furnace.
B. Vibration Isolators - 4 inches square by 1/2 inch thick minimum neoprene type vibration isolation pads.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install vibration isolator under each corner of upflow furnace.
B. Mount coils for tandem upflow furnaces using single coil over both furnaces served by single condensing unit.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service
1. Furnace distributor's technical service representative shall -

a) Verify proper gas orifice size.
b) Clock gas meter for rated input.
c) Verify and set gas pressure at furnace.
d) Check and measure temperature rise.
e) Check safety controls for proper operation.
f) Check combustion vent sizes and combustion air sizes.

2. In addition, furnace distributor's technical service representative shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

END OF SECTION 15532

SECTION 15557 - AIR PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.

B. Related Sections
   1. Division 09 - Painting
   2. Section 15055 - General Mechanical Requirements
   3. Section 15101 - General Piping Requirements

1.2 REFERENCES

A. American Society For Testing And Materials
   1. ASTM D 1785-96a, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120'
   2. ASTM D 2564-96a, 'Standard Specification for Solvent Cements for Poly(Vinyl Chloride)(PVC) Plastic Piping Systems'
   3. ASTM D 2661-96, 'Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings'
   4. ASTM D 2665-96, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Drain, Waste, and Vent Pipe and Fittings'

PART 2 PRODUCTS

2.1 MATERIALS

A. Air Piping - Schedule 40 pipe and fittings meeting requirements of ASTM D 1785, ASTM D 2661, or ASTM D 2665.

B. Primer & Cement - Meet requirements of ASTM D 2564.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation For Condensing Furnaces
   1. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
   2. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.

3. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.

B. Installation For Condensing Water Heaters
1. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Slope lines downward toward water heater.
2. Slope combustion chamber exhaust drain downward to floor drain.

END OF SECTION 15557

SECTION 15671- AIR-COOLED CONDENSING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install condensing units as described in Contract Documents.

B. Related Sections
   1. Division 02 - Concrete equipment slab
   2. Section 15051 - General Mechanical Requirements

1.2 SYSTEM DESCRIPTION

A. Performance Requirements - SEER rating as defined by ARI shall be not less than 13.0 for units 5 tons and less, and EER shall be not less than 10.4 for units over 5 tons.

1.3 SUBMITTALS

A. Quality Assurance / Control
   1. Equipment check-out sheets
   2. Technician certificate for use of CFC and HCFC refrigerants

1.4 QUALITY ASSURANCE

A. Qualifications - Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of CFC and HCFC refrigerants.

B. Requirements of Regulatory Agencies - Each unit shall be UL labeled.

C. Condensing Unit, cooling coil and furnaces shall be of same manufacturer.

1.5 WARRANTY

A. Five year warranty on compressors from date of 'start-up'. Record 'start-up' date on warranty certificate for each unit.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Condensing Units (10 Tons)
   1. General -
      a) Condensing units shall use R-410, or R-407C refrigerant.
      b) Make one liquid line, one suction line, and one power connection to each unit for each compressor in condensing unit. Provide charging valves.

c) Units shall be operable down to 35 deg F outdoor temperature.

2. Condenser Coils -
   a) Aluminum plate fins mechanically bonded to seamless copper tubes.
   b) Units having side inlets shall have coil guards.
   c) Coil shall be circuited for sub-cooling.
3. Fans -
   a) Direct driven propeller upflow type.
   b) Fan motors shall have inherent overload protection, be permanently lubricated, and resiliently mounted.
   c) Each fan shall have a safety guard.
   d) Cycle fans or use solid state fan speed control for low ambient operation.
4. Compressors -
   a) Hermetic or semi-hermetic design with following features -
      1) Spring isolators.
      2) Crankcase heater.
      3) Compressor motor overload protection.
      4) Ring, reed or disc type valves.
      5) Service valves, back-seating type with Schraeder charging valves.
   b) Semi-hermetic type shall have following additional features -
      1) Automatically reversible oil pump.
      2) Oil sight glass.
      3) Oil pressure switch.
   c) Condensing units ten tons or smaller shall have only one compressor. Condensing units larger than ten tons shall have two compressors minimum, each serving separate cooling circuit and coils.
5. Controls -
   a) Factory wired and located in separate enclosure.
   b) Factory installed safety devices -
      1) High and low pressure cutouts
      2) Internal or plug type relief valves
   c) Integral magnetic starters.
   d) Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
   e) Low ambient kit.
6. Casing -
   a) Fully weatherproof for outdoor installation. Finish shall be weather resistant.
   b) Panels shall be removable for servicing.
   c) Provide openings for power and refrigerant connections.
7. Approved Models -
   a) Furnace or Fan Coil / Boiler Systems -
      1) Carrier 38 ARZ or equal by
      2) Trane
      3) York

B. Condensing Units (5 Ton Unit)

1. General -
   a) Units shall be operable down to 35 deg F outdoor temperature.
   b) Condensing units shall use R-22 refrigerant.
   c) Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.
2. Condenser Coils -
   a) Aluminum plate fins mechanically bonded to seamless copper tubes or 'Spine Fin' trade mark system which has aluminum fins epoxy bonded to aluminum tubes.
   b) Provide coil guard for unit.
3. Fans -
   a) Direct driven propeller upflow type.
   b) Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.
   c) Motors shall be resiliently mounted.
   d) Each fan shall have a safety guard.
4. Compressor -
   a) Each condenser unit shall have only one compressor.
   b) Hermetic design with following features -
      1) Externally mounted brass service valves with charging connections.
      2) Crankcase heater.
      3) Resilient rubber mounts.
      4) Compressor motor overload protection.
      5) Single speed
5. Controls -
   a) Factory wired and located in separate enclosure.
   b) Factory installed safety devices -
      1) High and low pressure cutout
      2) Condenser fan motor overload devices
   c) Factory-installed anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
   d) Low ambient kit.
6. Casing -
   a) Fully weatherproof for outdoor installation. Finish shall be weather resistant.
   b) Openings shall be provided for power and refrigerant connections.
   c) Panels shall be removable for servicing.
7. Approved Models -
   a) Carrier 24 ABR or equal by
   b) Trane
   c) York

2.2 ACCESSORIES

A. Vibration Isolators - 4 inches square by 3/4 inch thick minimum neoprene type

vibration isolation pads

PART 3 EXECUTION

3.1 INSTALLATION

A. Set condensing units level on concrete slab on vibration isolation pads located at each corner of unit.

B. Do not use capillary tube and piston type refrigerant metering devices.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service
   1. Condensing units shall be started up, checked out, and adjusted by Condensing Unit Manufacturer's authorized factory trained service mechanic.
   2. Use equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

END OF SECTION 15671

SECTION 15729 - INDIRECT GAS FIRED MAKE-UP AIR UNIT WITH EVAPORATIVE COOLING

PART 1 - GENERAL

1.4 SCOPE

A. Furnish and install make-up air system as shown and scheduled on the drawings.

1.2 RELATED SECTIONS

A. General conditions, division 01 and section 15010 and 15050 apply to this section.
B. Installation of controls see section 15910.
C. Sequence of operation see section 15940

PART 2 - PRODUCTS

2.1 INTRODUCTION

A. Furnish packaged outdoor make-up air units of the size, type, as indicated on the drawings.
B. Each unit shall be shipped as a package with all internal wiring and piping connected and ready for single point field electrical and plumbing connections.
C. Each unit shall be complete including supply fan, inlet hood, filters, furnaces and evaporative wet section. Entire unit shall be factory tested.

2.2 HOUSING

A. Cabinet parts shall be constructed of minimum 20 gauge, G90U galvanized steel and finished with a hard gloss enamel.
B. The height of the unit shall not exceed 39".

2.3 BLOWER / MOTOR

A. Blower wheels shall be statically and dynamically balanced, forward curved double width, double inlet, with ball bearings, and V-belt driven through grooved cast iron pulleys.
   1. Driver sheaves to be variable pitched.
B. Blower motor shall be drip-proof, overload protected and mounted on an adjustable base.

2.4 STANDARD EVAPORATIVE COOLER

A. Cooler shall have 2" media on three sides.
B. Evaporative units shall have recirculating pump, water distributor, adjustable float valve, bleed-off tubing, control valve, and stainless steel bottom reservoir pan.

2.5 FURNACE

A. Heat exchanger shall be constructed of stainless steel and shall be warranted for five years.
B. Ribbon burners shall be aluminized steel with stainless steel inserts.
C. Burners, manifolds, orifices, flame sensor and ignitor to be easily removable as an assembly with access on the side of the unit.

2.6 CONTROLS

A. Gas and electric components shall be for each combustion chamber, main combination control with manual shut-off, two-stage regulator, main and redundant solenoid valves.
B. Other controls to include duct thermostat, high limit, fan safety switch, hot surface pilotless ignition system, 24-volt control transformer, and power vent with proving switch.

2.7 REMOTE CONTROL BOX

A. Shall include four-position push-button switch for OFF, HEAT, COOL and VENT positions.
    1. Colored pilot indicator lights shall be provided for heat, cool and vent.

2.8 OPTIONS AND ACCESSORIES

A. Factory installed
    1. Electronic modulation.
    2. Roll-out flame safety.
    3. ASTM-B117 1000 hr. salt spray certification on cabinet.
    4. Modulating gas valve.
B. Field installed
    1. Discharge damper kit.
C. Electrical
    1. Provide unit complete with motor, starter, power disconnect, and convenience outlet.
    2. Provide for single point connection for electrical.

2.9 APPROVED MANUFACTURERS

A. Ares 350 or equal by
B. United Metal Products
C. Modine with Airex Cooler
D. Trane
E. Reznor
F. Captive Aire

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturers instructions and recommendations.

3.2 QUALITY CONTROL

A. Check list provided by manufacturer shall be completed and turned into engineer prior to final inspection. Approved copies of checklist shall be placed in O & M Manuals

END OF SECTION 15729

SECTION 15805 - KITCHEN EXHAUST HOODS

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -

1. Kitchen grease hoods
2.

1.2 CODES:

A. Hoods shall be designed and tested with all applicable local and national codes including ASHRAE 110 - 1995, BS 7258, and DIN 12 924.

PART 2 - PRODUCTS

2.1 GREASE HOOD:

A. General:

1. The hood shall be a compensating wall canopy ventilator rated for all types of cooking equipment.
2. Shall be capable of providing up to 80% make-up air through a front perforated stainless steel plenum.
3. The hood shall have size, shape and performance specified on drawings.

B. Hood Construction:

1. Construction shall be type 430 stainless steel with a #3 or #4 polish where exposed.
2. Individual component construction shall be determined by manufacturer, UL, and NSF.
3. Construction shall be dependent on the structural application to minimize distortion and other defects.
4. All seams, joints and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapor and exhaust gases shall have a liquid tight continuous external weld in accordance with NFPA.
5. Hood shall be wall type with a minimum of four connections for hanger rods.
6. Connectors shall have 9/16" holes prepunched in 1 ½" X 1 ½" angle iron at the factory to allow for hanger rod connection by others.

C. Accessories and Options:

1. Ventilator shall be furnished with U.L classified aluminum baffle filters, supplied in size and quantity as required by ventilator. The filters shall extend the full length of the hood and the filler panels shall not be more than 6".

2. The hood manufacturer shall supply complete computer generated submittal drawings including hood sections view(s) and hood plan view(s). These drawings must be available to the engineer, architect and owner for their use in construction, operation and maintenance.
3. Exhaust duct collar to be 4" high with 1" flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate with 1 ft increments along the length of the ventilator.
4. U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4'0" spacing on center and allow up to a 100 watt standard light bulb.
5. A double wall insulated front to eliminate condensation and increase rigidity. The insulation shall have a flexural modulus of 475 EI, meet U.L. 181 requirements and be in accordance with NFPA 90A and 90B.
6. An integral front baffle to direct grease laden vapors toward the exhaust filter bank.
7. The grease drain system shall be an integral part of the hood back and have a minimum 1/8" per foot slope with an exposed, removable ½ pint grease cup to facilitate cleaning.
8. The front plenum shall provide make-up air through perforated stainless steel panels.
9. All seams shall be welded and have stainless steel on exposed surfaces. Unexposed surfaces shall be constructed of aluminized steel. Perforated diffuser plates shall be included in the design, to provide even air distribution and the plenum shall be insulated to prevent condensation.
10. The hood shall be UL listed as “Exhaust Hood Without Exhaust Damper”, NFS listed and built in accordance with NFPA 96. Hood shall be recognized by ICBO, BOCA, and SBCCI. A built in wiring chase shall be provided for outlets and electrical controls on the hood face and shall not penetrate the capture area or require an external chaseway.
11. Provide with quarter end panels.

2.2 FIRE SUPPRESSION SYSTEM:

A. An Ansul Fire Suppression System or prior approved equal shall be furnished. The system shall be capable of protecting all hazard areas associated with cooking equipment.

1. References:

   a. Underwriters Laboratories Inc (UL). - UL Standard 1254, UL Standard 300.
   b. National Fire Protection Association (NFPA) - NFPA 96, NFPA 17A
   c. Submittals

1) Submit two sets of manufacturer's data sheets.
2) Submit two sets of piping design drawings.

B. The system shall be an automatic fire suppression system using a wet chemical agent for grease related fires. The system shall be capable of suppressing fires in the following areas associated with cooking equipment: ventilating equipment including hoods, ducts, plenums, and filters; fryers; griddles and range tops; upright, natural charcoal, or chain type broilers; electric, lava rock, mesquite or gas radiant char-broilers. The system shall be pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories Inc. (UL). The system shall be installed and serviced by personnel trained by the manufacturer.

C. Quality Control:

1. Manufacturer:

a. The R-102 Restaurant Fire Suppression System shall be manufactured by a company with at least thirty years experience in the design and manufacture of pre-engineered fire suppression systems.
b. The manufacturer shall be ISO 9002 registered.

2. Certificates:

a. The wet agent shall be a specifically formulated, aqueous solution of organic salts with a pH range between 7.8 - 8.2, designed for flame knockdown and foam securement of grease related fires.

D. Warranty, Disclaimer, and Limitations:

1. The pre-engineered restaurant fire suppression system components shall be warranted for five years from date of delivery against defects in workmanship and material.

E. Delivery:

1. All system components shall be securely packaged to provide protection during shipment.

F. The R-102 system shall be capable of operating in a temperature range of 32°F to 130°F (0°C to 54°C).

G. Components:

1. The basic system shall consist of an ANSUL AUTOMAN regulated release assembly which includes a regulated mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links,

and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, pressure switches, and electrical switches for automatic equipment and gas line shut-off.

2. The extinguishing agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.8 - 8.2, designed for flame knockdown and foam securement of grease related fires.
3. The agent tank shall be installed in a stainless steel enclosure or wall bracket. The tank shall be deep drawn carbon steel finished in red enamel. Tanks shall be available in two sizes; 1.5 gallon (5.7 L) and 3.0 gallon (11.4 L). The tanks shall have a working pressure of 100 psi (6.9 bar), a test pressure of 300 psi (20.7 bar), and a minimum burst pressure of 600 psi (41.4 bar). The tank shall include an adaptor/tube assembly containing a burst disc union.
4. The regulated release mechanism shall be a spring loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used. It shall contain a factory installed regulator deadset at 100 psi (6.9 bar) with an internal relief of approximately 145 psi (10.0 bar). It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station. The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for ½ in conduit. The cover shall contain an opening for a visual status indicator. It shall be compatible with mechanical gas shut-off devices; or, when equipped with a field of factory - installed switch, it shall be compatible with electric gas line or appliance shut-off devices.
5. When more than two agent tanks are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. The regulator shall be deadset at 100 psi. (6.9 bar) with an internal relief of approximately 145 psi (10.0 bar). The regulated actuator assembly shall contain a regulated actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.
6. Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzles tips shall be stamped with the flow number designation (½, 1, 2 and 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build up.
7. Distribution piping shall be Schedule 40 black iron, chrome plated, or stainless steel pipe conforming to ASTM A120, A53, or A106.

8. The detectors shall be the fusible link style designed to separate at a specific temperature.
9. The cartridge shall be sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.

H. Training:

1. Manufacturer shall provide a minimum of 2 hours of Owner training.

2.4 ELECTRICAL CONTROLS:

A. The ETL listed Electrical Control Panels shall be single phase, and factory mounted inside cabinet adjacent to hood. The panels include color coded wiring with wiring diagrams, and spare terminals controlled by the fire system micro switch. Factory pre-wired tp shut down supply fans in a fire condition. Factory pre-wire option to turn on the exhaust fans in a fire condition. Red pilot light fan switches illuminates when the switch is in the on position. Panel shall be ETL listed to US Standards for installation in the integral Utility Cabinet.

B. Controls package shall control exhaust hoods, fans, fire suppression system, and make-up air unit. Controls shall have a manual switch to turn on exhaust and make-up air system. Exhaust and make-up air shall be interlocked to run together at all times except in case of fire. Make-up air unit shall be controlled to maintain adjustable discharge air temperature, with space temperature re-set.

2.5 APPROVED MANUFACTURERS:

A. Captive Aire
B. Aqua Matic
C. Econ Air
D. Por approved equal

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install per manufacturer’s recommendations.

B. Coordinate with make-up air unit and all other disciplines.

END OF SECTION 15805

SECTION 15812 - ROUND STEEL DUCTWORK

PART 1 - GENERAL

1.1 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL -

A. Ducts -
   1. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80, "Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with Type G coating.
   2. Use of aluminum or non-metal ducts is forbidden.
   3. Duct shall be constructed to SMACNA Pressure Class ½" to 2" standards.

B. Joints
   1. Mechanical type joints shall be sealed with sealant as specified in Section 15820
   2. Welded joints are acceptable.
   3. Joints shall be as recommended in SMACNA HVAC Duct Construction Standards for round duct.

C. Fittings:
   1. Ducts shall be provided with 45 and 90 degree elbows of 2 piece die stamped construction.

D. Ductwork shall be shop fabricated or spiral ductwork manufactured by a manufacturer regularly engaged in the manufacture of this type of ductwork. Ductwork shall meet all requirements of SMACNA and manufacturer be prior approved.

E. Standing seam duct may be used in lieu of spiral duct if properly constructed for velocity and pressures encountered.

F. Duct take-offs and volume dampers. See Section 15821.

PART 3 - EXECUTION

3.1 PERFORMANCE -

A. Ducts
   1. Straight and smooth on inside with joints neatly finished unless otherwise directed.

END OF SECTION 15812

SECTION 15814 - WELDED BLACK STEEL DUCTWORK

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Furnish and install the ½" to 2" wg welded black steel ductwork and related items specified below and shown on the Drawings.
   2. Ductwork shall be installed in strict accordance with SMACNA Standards (latest edition) and IMC requirements for grease ductwork serving type 1 cooking hoods.

B. Related Work Specified Elsewhere -
   1. General Division 01 and Section 15010 and 15051 are a part of this Section.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL -

A. Fabricate of 16 ga. steel sheets meeting requirements of ASTM A 527-80.
B. Use of aluminum, galvanized, or non-metal ducts is forbidden.

PART 3 - EXECUTION

3.1 DUCTS -

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.
B. All joints shall be butt welded in accordance with IMC requirements.
C. Brace and install ducts so they shall be free of vibration under all conditions of operation.
D. Duct shall slope towards hood at a minimum slope of 2% (1/4" rise in 12" of run).
E. Connection to exhaust fan shall be by flange and gasket per requirements of IMC.
F. Ductwork shall be installed per all requirements of International Mechanical Code, SMACNA Standards, IMC, UL, and Governing Authority Requirements for type 1 grease laden cooking hoods.
G. Concealed portions of this duct system are required to be wrapped in a fire resistant wrap. See Section 15081 for duct wrap.

END OF SECTION 15814

SECTION 15816 - STEEL DUCTWORK

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Furnish and install the ½" to 2" wg ductwork and related items specified below and shown on the Drawings.
   2. Ductwork shall be installed in strict accordance with SMACNA Standards (latest edition) for exterior installation.

B. Related Work Specified Elsewhere -
   1. General Division 01 and Section 15010 and 15051 are a part of this Section.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL -

A. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80 with Type G coating.

B. Use of aluminum or non-metal ducts is forbidden.

PART 3 - EXECUTION

3.1 DUCTS -

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.

B. Duct panels through 48 inch dimension having acoustic duct liner need not be crossbroken or beaded.

C. Brace and install ducts so they shall be free of vibration under all conditions of operation.

D. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.

E. Ducts shall be large enough to accommodate inside acoustic duct liner.

F. Install internal ends of slip joints in direction of flow. Make joints air tight using mastic type duct sealer.

G. Cover horizontal and longitudinal joints on all ducts with two layers of hardcast tape installed with hardcast HC-20 adhesive according to manufacturer's recommendations, or equivalent by Duro Dyne Corporation or H.B. Fuller Company.

H. Paint duct the color approved by an architect.

I. Install flexible inlet and outlet duct connections to furnaces and make up air unit.

J. Provide each duct take-off with an adjustable volume damper to balance that branch.

K. Anchor dampers securely to duct.

L. Install dampers in main ducts within insulation.

M. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

N. Install grilles and diffusers.

3.2 AIR TURNS -

A. Permanently installed, consisting of curved metal blades or vanes arranged to permit air to make abrupt turn without appreciable turbulence, in elbows of supply and above ground return ductwork.

B. Air turns shall be quiet and free from vibration when system is in operation.

END OF SECTION 15816

SECTION 15818 - FLEXIBLE DUCT

PART 1 - GENERAL

1.1 DESCRIPTION -

A. Includes But Not Limited To -
   1. Supply air branch duct runouts to diffusers where indicated on Drawings.

B. Related Work Specified Elsewhere -
   1. Volume dampers and sheet metal duct specified in Section 15 812.

1.2 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL -

A. Ducts -
   1. Formable, flexible, circular duct which shall retain its cross-section shape, rigidity, and shall not restrict air flow after bending.
   2. Nominal 1-1/2 inches thick, 3/4 lb/cu ft density fiberglass insulation with air-tight, see-through polyester core, sheathed in seamless vapor barrier jacket factory-installed over flexible assembly.
   3. Each individual component in assembly, including insulation, ductwork and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   4. Approved Manufacturers -
      a) Flexmaster
      b) Thermaflex
      c) Wiremold

PART 3 - EXECUTION

3.1 INSTALLATION -

A. Install duct in fully extended condition free of sags and kinks, using 3'-0" maximum lengths.

END OF SECTION 15818

SECTION 15819 - DUCTWORK TESTING

PART 1 - GENERAL

1.1 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURE

A. All ductwork shall be tested prior to concealing or other work which may prevent repair of ductwork. Refer to "Inspection Notice", Section 15051.

B. Duct testing shall consist of pressurizing the duct system either with the main blower or in sections using a portable blower. Each portion of ductwork to be tested shall be sealed at all openings. The ductwork shall be subjected to an internal pressure not less than 2" W.G or 1-1/2 times working pressure whichever is larger. All ductwork shall be surveyed for audible leaks, and structural stability. Leaks shall be sealed, weak joints repaired, vibrations eliminated. A log shall be kept by the contractor indicating date, conditions, repairs made, and name of individual(s) performing the test. A copy of the log shall be retained for possible observation at the request of the Owner or architect. Ductwork shall maintain test pressure with not more than 10% variation over the period of the test.

END OF SECTION 15819

SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Sections
   1. Section 15051 - General Mechanical Requirements

1.2 REFERENCES

A. American Society for Testing and Materials
   1. ASTM A 653-96, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'
   2. ASTM C 665-96, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing'
   3. ASTM C 1071-91, 'Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)

PART 2 PRODUCTS

2.1 COMPONENTS

A. Flexible Equipment Connections
   1. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
   2. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 200 deg F.
   3. Approved Manufacturers -
      a) Cain - N-100
      b) Duro Dyne - MFN
      c) Elgen - ZLN
      d) Ventfabrics - Ventglas

B. Duct Access Doors
   1. Factory built insulated access door with hinges and sash locks. Construction shall be galvanized sheet metal, 24 ga minimum.
   2. Fire and smoke damper access doors shall have a minimum clear opening 12 inches square or as shown on Drawings to easily service fire damper.
   3. Approved Manufacturers -
      a) AirBalance - Fire/Seal FSA 100
      b) Cesco-Advanced Air - HAD-10
      c) Elgen - Model 85 A

d) Flexmaster - Spin Door
e) Kees Inc - ADH-D
f) Pottorff - 60-HAD
g) Ruskin - ADH-24
h) Safe-Air - SAH

C. Dampers & Damper Accessories
1. Concealed Ceiling Damper Regulators -
a) Approved Manufacturers -
1) Cain
2) Duro Dyne
3) Metco Inc
4) Vent-Lock - 666
5) Young - 301
2. Volume Dampers -
a) Factory-manufactured 16 gauge galvanized steel, single blade and opposed blade type with 3/8 inch axles and end bearings. Blade width 8 inches maximum. Blades shall have 1/8 inch clearance all around.
1) Damper shall operate within acoustical duct liner.
2) Provide channel spacer equal to thickness of duct liner.
b) Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
c) Approved Manufacturers -
1) American Warming
2) Arrow
3) Cesco
4) Daniel
5) Greenheck
6) Pottorff
7) Ruskin
8) UTEMP
9) Safe-Air

D. Air Turns
1. Single thickness vanes with one inch trailing edge. Double thickness vanes not acceptable.
2. 4-1/2 inch wide vane rail. Junior vane rail not acceptable.

E. Branch Tap for Round and Flexible Ductwork (High efficiency type)
1. Factory-manufactured rectangular-to-round or round-to-round 45 degree leading tap fabricated of 24 ga zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 653, with G-90 coating.
2. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
3. Manual Volume Damper -
a) Single blade, 22 ga minimum
b) 3/8 inch minimum square rod with brass damper bearings at each end.
c) Heavy duty locking quadrant on 1-1/2 inch high stand-off mounting bracket attached to side of round duct.

4. Approved Models & Manufacturers -
   a) HETD-L by Daniel Manufacturing, Ogden, UT (801) 622-5924
   b) STO by Flexmaster USA Inc, Houston, TX (713) 462-7694
   c) HET by Sheet Metal Connectors Inc, Minneapolis, MN (612) 572-1100
   d) Prior approved equal

F. Motorized Outside Air Dampers -
1. Low leakage type. AMCA certified.
2. Damper Blades -
   a) Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch blade width maximum measured perpendicular to axis of damper.
   b) Jamb seals shall be flexible metal compression type.
   c) Opposed or single blade type.
3. Make provision for damper actuators and actuator linkages to be mounted external of air flow.
4. Approved Manufacturers And Models -
   a) Air Balance - AC 526
   b) American Warming - AC526
   c) Arrow - AFD-20
   d) C & S - AC50
   e) Cesco - SCDS and SDI
   f) Honeywell - D-643
   g) Pottorff - CD-52
   h) Ruskin - CD-60

2.2 FABRICATION

A. Air Turns
1. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
2. Quiet and free from vibration when system is in operation.

2.3 DUCT SEALER FOR INTERIOR DUCTS

A. Approved Products -
1. Duct Butter or Butter Tak by Cain Manufacturing Co Inc.
2. DP 1010 by Design Polymerics
3. S2 by Duro Dyne
4. Versa Grip 102 by Hardcast Inc.
5. 15-325 by Kingco, King Adhesive Corp.
6. 44-41 by Mon-Eco Industries Inc.
7. Airseal #11 by Polymer Adhesive Sealant Systems Inc.
8. Multipurpose Duct Sealant by Trans-Continental Equipment Co.
9. Water Base Duct Sealer by United McGill Corp.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install flexible inlet and outlet duct connections to each furnace.

B. Access Doors In Ducts

1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches of installed dampers.
2. Install within 6 inches of fire dampers and in Mechanical Room if possible.

C. Dampers & Damper Accessories

1. Install concealed ceiling damper regulators.
   a) Paint cover plates to match ceiling tile.
   b) Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
2. Provide each take-off with an adjustable volume damper to balance that branch.
   a) Anchor dampers securely to duct.
   b) Install dampers in main ducts within insulation.
   c) Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
   d) Where concealed ceiling damper regulators are installed, provide cover plate.

D. Install motorized dampers.

END OF SECTION 15820

SECTION 15821 - FIRE DAMPERS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install fire dampers described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies
   1. Dampers shall conform to NFPA and SMACNA requirements and bear UL label.
   2. Dampers shall be approved by fire authorities having jurisdiction where so required.
   3. Wall fire dampers shall conform to UL 555 ‘Fire Damper Test Standard’

1.3 MAINTENANCE

A. Extra Materials - Leave six fusible links of each rating type used on Project with Owner.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Fire Dampers
   1. Walls
      a) Type 'B', blades out of airstream
      b) Include integral sleeve
      c) 165 deg F link unless otherwise indicated on Drawings
      d) Approved Manufacturers & Models -
         1) Air Balance Inc - Model 119BLX
         2) Greenheck - Model FD150XB
         3) Potorff - Model VFD-10 NSB
         4) Ruskin - Model IBD20B
         5) Safe Air Inc - Model 150B Sleeved
         6) Equals by Cesco or Prefco as approved by Architect before bidding. See Section 01600.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire dampers as follows

1. Install fire dampers in ducts where ducts penetrate fire rated walls.

END OF SECTION 15821

SECTION 15822 - ACOUSTICAL DUCT LINER

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Acoustical lining of all rectangular supply, exhaust, and return air ductwork except supply air ductwork carrying evaporative cooled air.

B. Insulation materials, adhesives, coatings, and other accessories shall have surface burning characteristics as determined by ASTM E 84 not to exceed 25 for flame spread and 50 for smoke developed. Flame proofing treatments subject to deterioration due to the effect of moisture or high humidity are not acceptable.

C. Duct dimensions shown on drawings are for inside of duct liner and does not include liner insulation.

1.2 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 DUCT LINER -

A. One inch thick, 1-1/2 lb density fiberglass.

B. Approved Manufacturers -
   1) CSG Ultralite OR Tough guard
   2) Johns-Manville Lina-Coustic
   3) OCF Aeroflex
   4) Knauf Type M

2.2 ADHESIVE -

A. Approved Water Base Products -
   1) Cain - Hydrotak
   2) Design Polymerics - DP2501 or DP2502 (CMCL-2501)
   3) Duro Dyne - WSA
   4) Hardcast - IA-901
   5) Kingco - 10-568
   6) Miracle - PF-101
   7) Mon-Eco - 22-67
   8) Polymer Adhesive - Glasstack #35
   9) Techno Adhesive - 133
   10) United McGill - Uni-tack

2.3 MECHANICAL FASTENERS -

A. Conform to Mechanical Fastener Standard MF-19/1.

B. Pins that attach to ductwork with adhesives are not allowed.

C. Approved Manufacturers -

1) Duro Dyne
2) Omark dished head "Insul-Pins"
3) Grip nails may be used if each nail is installed by "Grip Nail Air Hammer" or by "Automatic Fastener Equipment" in accordance with Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with a continuous 100% coat of adhesive and with mechanical fasteners spaced as shown on drawings. Pin all duct liner.

B. Accurately cut liner and thoroughly coat exposed edges of duct liner, including diffuser drop cut-outs with adhesive to seal fibers. Butt joints tightly. Top and bottom sections of insulation shall overlap sides.

C. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty.

D. If insulation is installed without horizontal, longitudinal, and end joints butted together and properly treated, installation will be rejected and work removed and replaced with work that conforms to this specification. See drawings for detail of joint treatment.

END OF SECTION 15822

SECTION 15836 - EXHAUST FANS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install exhaust fans as described in Contract Documents.

B. Related Sections
   2. Section 15010 - General Mechanical Requirements

1.2 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies - Bear AMCA seal and UL label.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Ceiling Mounted Exhaust Fans -
   1. Acoustically insulated housings. Sound level rating of 4.6 sones maximum for fan RPM and CFM listed on Drawings.
   2. Include chatterproof integral back-draft damper with no metal to metal contact.
   3. True centrifugal wheels.
   4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
   5. Suitably ground motors and mount on rubber-in shear vibration isolators.
   6. Provide wall or roof cap, as required.
   7. Approved Manufacturers -
      a) Breidert
      b) Carnes
      c) Cook-Gemini
      d) Greenheck Sp
      e) Pace
      f) Penn Zephyr

B. Up Discharge Roof Mounted Exhaust Fans
   1. Direct drive of have adjustable pitch V-belt as noted on drawings.
   2. Wheels shall be backward curved and housing shall be removable or hinged aluminum.
   3. Isolate motor with vibration dampeners.
   4. Provide quiet type back-draft dampers.
   5. Have up discharge air flow configuration.
   6. Be UL listed for kitchen use and include all necessary accessories.
   7. Approved Manufacturers -
      a) Cook
      b) Breidert
      c) Carnes

d) Acme
e) Greenheck
f) Penn
g) Captive Aire

2.2 ACCESSORIES

A. Curbs for Roof-Mounted Exhaust Fans
1. Insulated, pre-fabricated metal roof curb for roof configuration shown on Drawings.
2. Approved Manufacturers -
a) Sound Attenuating Curbs -
1) Penn
2) Carnes
3) Breidert
4) Greenheck
5) Cook
6) Acme
7) Captive Aire

PART 3 EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or to curb.

END OF SECTION 15836

SECTION 15851 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents
   2. Quality of grilles installed in metal doors

B. Related Sections
   1. Section 15051 - General Mechanical Requirements

1.2 MAINTENANCE

A. Extra Materials - Leave tool for removing core of each different type of grille for building custodian.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Ceiling Return, Exhaust, And Transfer Grilles
   1. Finish - Off-white baked enamel
   2. 1/2 inch spacing.
   3. Approved Manufacturers And Models -
      a) Price - 535
      b) Carnes
      c) J & J
      d) Krueger
      e) Metalaire
      f) Titus
      g) Tuttle & Bailey
      h) Agitair
      i) Anemostat
      j) Barber Colman
      k) Environmental Air Products
      l) Air Control Products
      m) Nailor

B. Ceiling Diffusers
   1. Finish - Off-white baked enamel
   2. Approved Manufacturers And Models -
      a) Price - SMD-6
      b) Carnes
      c) J & J
      d) Krueger
      e) Metalaire
      f) Titus
      g) Tuttle & Bailey

h) Agitair
i) Anemostat
j) Barber Colman
k) Environmental Air Products
l) Air Control Products
m) Nailor

PART 3 EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side. Level floor registers and anchor securely into floor.

END OF SECTION 15851

SECTION 15855 - ROOF MOUNTED AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SUMMARY:

A. Includes But Not Limited To
   1. Furnish and install the roof mounted penthouses as scheduled in Contract Documents.

B. Related Sections
   1. Section 15010 - General Requirements

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS:

A. Penthouse
   1. Penthouse type of extruded aluminum complete with roof curb and 1/2 inch mesh 16 gauge aluminum bird screen.
   2. Finish shall be anodized aluminum.
   3. Approved Manufacturers -
      a) Louvered Penthouse -
         1) Model RLX by Breidert Co
         2) Model GLAB by Carnes Company
         3) Model WRH by Greenheck Fan Corporation

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install in accordance with Manufacturer's recommendations.

END OF SECTION 15855

SECTION 15861 - AIR FILTERS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install filters used in mechanical equipment.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Furnace and Make-up Air Unit Filters - One inch thick throw-away type as recommended by Manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide ample access for filter removal.

3.2 FIELD QUALITY CONTROL

A. Inspection - At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION 15861

SECTION 15915 - ELECTRIC & ELECTRONIC CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install automatic temperature control system as described in Contract Documents.
   2. Furnish and install conductors and make connections to control devices and equipment.
   3. Furnish and install raceway and conduit in for all control wiring.
   4. Assist in air test & balance procedure.

B. Related Sections
   1. Section 15055 - General Mechanical Requirements
   2. Section 15820 - Furnishing and installing of temperature control dampers
   3. Section 15941 - Sequence of Operation
   3. Division 16 -
      a. Power wiring to magnetic starters, disconnect switches, and motors.
      b. Motor starters and disconnect switches, unless integral with packaged equipment.

1.2 SYSTEM DESCRIPTION

A. Performance Criteria - Install all control line and low voltage electrical wiring, raceway, conduit, and boxes in accordance with Division 16 of these Specifications.

1.3 SUBMITTALS

A. Project Record Documents - Provide two copies of record ATC diagrams

PART 2 PRODUCTS

2.1 GENERAL

A. System controls shall be single manufacturer's products.
B. Controls system shall be stand alone, web enabled DDC.
C. Approved Controls:
   1. Utah Controls
   2. Honeywell
   3. Johnson

2.2 COMPONENTS

A. Remote Room Sensor
   1. Provide with push-button 3 hr occupied over-ride, and warmer-cooler slide stat for manual adjustment.
   2. Sensor Guards -
      a. All Systems-
         1) Cam key locking, heavy duty perforated metal.

B. Safety Controls
   1. Ionization smoke detector mounted in return air stream. Detector to operate on 120 volts AC.
   2. Install on systems greater than 2000 CFM.

F. Damper Actuators
   1. Electric type equipped for Class I wiring.
   2. Shall not consume power during UNOCCUPIED cycle or use chemicals or expandable media.
   3. Have built in spring return.

2.3 HOST COMPUTERS:

A. Provide the following host computer:
B. Building host computer shall have as a minimum the following:
   1. IBM compatible Pentium IV 2.4 GHZ Laptop Computer
   2. 1 GB DDR RAM memory
   3. 30 GB hard drive
   4. CD/DVD RW drive
   5. Two USB Ports
   6. Operating system (Microsoft Windows XP Professional)
   8. Approved Manufacturers
      a. Dell
      b. Compaq/HP
      c. Prior Approved Equal
C. The ATC contractor to provide a fully operational DDC control system that may be monitored, controlled & modified from the Centralized Host computer shall construct the controlling software database. All control schedules, algorithms, and control logic shall be in place within each DDC controller and stored as back-up copies on the Host computers hard disk which may be down-loaded to individual DDC controllers as necessary. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences.
D. The building shall be represented by complete graphical floor plans, with accurate locations of each major piece of HVAC equipment. A zoom feature shall allow the operator to select any of the main fan systems, and see a graphical representation of the system with dynamic representation of all appropriate DDC input & output devices. Each major piece of HVAC equipment shall be graphically represented at the Host computer with all appropriate DDC points dynamically represented.
E. Controls manufacturer shall provide cable kit or other interface as required to connect to host computer in order to provide fully operational and functional

network system.

2.4 HARDWARE LEVEL WEB SERVER (HLWS):

A. Acceptable manufacturers and products: Echelon I.LON Series, TAC Xenta 5XX Series, Tridium Jace 545 or equal.
B. HLWS shall be provided for human machine interface (HMI) to nodes, via standard web browsers over a local intranet or the Internet.
D. HLWS shall be installed on the LONWORKS® network to communicate to nodes via Type 1 transceivers.
E. The HLWS shall have Ethernet connection and IP addressing to allow connection to intranet or Internet. Configuration settings shall be stored on the HLWS.
F. HLWS shall be non-PC based.
G. Operator password levels shall be set and used to control user rights and access.
I. The HTML based web pages shall be able to present trend logs, color graphics and alarms, which can be created, downloaded and maintained via a software tool.
J. The operator shall be able to view and change setpoints, view status and operating conditions.
K. The operator shall be able to activate and view trends.
L. The operator shall be able to view alarm status. The operator shall be able to read, acknowledge, block, and sort alarms.
M. Settings, like configuration and web pages, shall be stored in non-volatile (flash) memory.
N. Provide serial and modem connections.

2.5 WEB BROWSER CLIENTS:

A. The system shall support web clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™.
B. The Web browser software shall run on Microsoft Windows platforms.
C. The Web browser shall provide the same view of the system, in terms of graphics, logs, alarms, and provide the same interface methodology as is provided by the HMI.
D. The Web browser client shall support at a minimum, the following functions:
E. User log-on identification and password shall be required. If an unauthorized user attempts access the log-on screen is re-displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
F. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
G. Storage of the graphical screens shall be in the Web Server without requiring any graphics to be stored on the client machine.
H. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

I. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

J. Modify common application objects, such as set points, in a graphical manner. Commands to start and stop binary objects shall be done by clicking or double clicking, the selected object and selecting the appropriate command from the pop-up menu.

K. View logs, charts, and trend reports

L. View and acknowledge alarms.

M. Loading of additional software at the web-client is not acceptable. This must be performed via upload from the web-server.

N. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.6 WARRANTY:

A. The HVAC Control System shall be free from defects in workmanship and material under normal use and service. If within twelve (12) months from the date of substantial completion, the installed equipment is found to be defective in operation, workmanship or materials, the building systems contractor shall replace, repair or adjust the defect at no cost.

B. The warranty shall extend to material that is supplied and installed by the Contractor. Material supplied but not installed by the Contractor shall be covered per the above to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation.

C. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

PART 3 EXECUTION

3.1 INSTALLATION

A. Interface With Other Work

1. Calibrate room thermostats as required during air test & balance.
2. Instruct air test & balance personnel in proper use and setting of control system components.

B. Run wiring in conduit. No exceptions.

C. Safety Controls

1. Mount smoke detector in return air ducts of each heating and/or cooling system as shown on Control Drawings and interlock to keep heating and cooling from operating if detector is energized.
2. Interlock gas valves with cooling compressors and supply air fan.
3. Gas valves shall obtain their electrical control power from same circuit as supply fan motor.
4. Check high limit thermostats furnished with heating equipment for correct operation. Gas valves shall close when duct temperature

exceeds high limit setting. Perform this work immediately after wiring burner controls.

5. Bonnet thermostatic switches furnished with heating equipment shall be wired to dissipate all heat in combustion chambers.
6. Fresh air dampers shall close on fan shut-down, power failure, open fan motor disconnect switch, and when thermostat is in UNOCCUPIED mode.
7. Gas burner safety controls furnished with furnace units shall be incorporated in control circuits for all modes of operation.
8. Control furnace systems with two or more furnaces serving common zone as one unit with twinning kit. Motors shall start and stop together and gas valves operate together.

D. Mount damper actuators and actuator linkages external of air flow.

E. Paste copy of record control wiring diagram on back of relay panel door cover for each twin furnace system.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service - Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before presubstantial completion inspection.

3.3 ADJUSTING

A. Program minimum of one days operation into thermostat's memory function.

END OF SECTION 15915

SECTION 15941 - SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. Performance Requirements

1. Dining Hall -
   a. Programmable thermostat shall control unoccupied and occupied status of fan system based on adjustable seven day program and remote room sensor**/**push button. Fan shall run continuously in occupied mode and cycle in unoccupied mode.
   b. Auxiliary fan cycle switch is provided by thermostat sub-base and is to be used to cycle fan in occupied mode.
   c. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable thermostat provides automatic change over between heating and cooling.
   d. Remote Room Sensor provides optional override of thermostat program by allowing three hour timed override of thermostat program at any time by pushing selected point on remote room sensor cover. This shall activate thermostat to occupied mode and system shall control to occupied set point.
   e. Minimum outside air damper (spring return type) shall open in occupied mode and remain closed in unoccupied mode.
2. Restroom/ Storage Room System -
   a. Programmable thermostat shall control unoccupied and occupied status of fan system based on adjustable seven day program and remote room sensor **/** push button. Fan shall cycle in unoccupied and occupied modes.
   b. Auxiliary fan cycle switch is provided by thermostat sub-base and is to be used to cycle fan in Occupied mode on both heating and cooling.
   c. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable thermostat provides automatic change over between heating and cooling.
   d. Remote room sensor provides optional override of thermostat program by allowing three hour timed override of thermostat program at any time by pushing selected point on remote room sensor cover. This shall activate thermostat to occupied mode and system shall control to occupied set point.
   e. Minimum outside air damper, spring return type, shall open in occupied mode and remain closed in unoccupied mode in zones using outside air.

3. Kitchen Area System -
   a. Make up air unit shall be interlocked with the hood exhaust fan such that the they will always run simultaneously.
   b. The system shall cycle in the unoccupied mode to maintain the space temperature at 65˚F adjustable. Unit shall normally be in this mode. When an on-off switch on the hood is placed in the on position, or when the hood heat sensor is activated, the system shall go to the occupied position and the fans shall run continuously. The gas valve or evaporative cooler pump shall cycle to maintain a discharge air temperature of 75˚F adjustable.
   c. Additional interlocks required by code or equipment manufacturer shall be incorporated into the circuits to insure equipment will not operate when the hood exhaust fan is not in operation.
   d. In the unoccupied mode and the thermostat is calling for cooling the system shall not operate.
   e. Outside air intake damper shall be open when make-up air unit fan is in operation and closed at all other times.
4. Restroom Exhaust Systems
   a. Restroom exhaust fans shall be tied into the thermostat to operate when the system is in occupied mode.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION 15941

SECTION 15960 - AIR SYSTEM TEST AND BALANCE

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Testing, balancing and adjusting of the following systems:
      a) Supply and Return Air
      b) Exhaust Air
   2. Test Report bound in Operating and Maintenance Manuals.
      3 Contractor shall make changes in pulleys, belts, motors and dampers or add dampers as required for correct balance as recommended by Air Balance & Testing Agency at no additional cost to Owner.

1.2 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.3 AGENCY:

A. Contractor shall procure services of an independent Air Balance & Testing Agency which specializes in balancing and testing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
B. Agency shall provide proof of having successfully completed at least five projects of similar size and scope and be a certified AABC, NEBB, or TABB agency. Work by this Agency shall be done under direct supervision of a qualified registered professional heating and ventilating engineer employed by Agency. Agency shall maintain an office within 75 miles of project.
C. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
D. If requested, conduct tests in presence of Architect.
E. Agency shall be approved in writing by the Architect. Neither Architect's Engineer or anyone performing other work on this Project under Division 15 shall be permitted to do this work.
F. Contractor shall award test and balance contract to the approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.
G. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of the Air Balancing Test Report.
H. Architect will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire project.
I. Rebalancing shall be done in presence of Architect and subject to his approval.
J. Spot balance and rebalance shall be performed at no additional cost to Owner.
K. Approved Balancing Agencies

1) Bonneville Balancing
2) BTC Services
3) Certified Test and Balance
4) Danis Test and Balance
5) Intermountain Test and Balance
6) Testing and Balancing Inc
7) RS Analysis

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin air balance and testing upon completion of the mechanical installation of air conditioning, ventilation, heating, exhaust systems, and controls including installation of all specialties and devices.

3.2 PROCEDURES:

A. Before any adjustments are made, the system is to be checked for items such as dirty filters, filter leakage, major duct sections, zones, etc.
B. Contractor shall place exhaust and ventilating systems and equipment into full operation and continue their operation during each working day of testing and balancing.
C. Air Balance & Testing Agency shall perform tests specified, compile test data, and submit four copies of complete test data to Contractor for forwarding to Engineer for evaluation and approval.
    1. Approved copies of report shall be bound in Operations & Maintenance Manuals. See Division 15010 General.
D. Systems shall be completely balanced and all reports submitted to Architect's Mechanical Engineer a minimum of 72 hours prior to test run and final inspection.
E. System performance shall be checked when outside weather is at or near design conditions, if practicable. Heating and/or cooling thermometers or sensors shall be placed in the areas served by each fan system. Temperature readings shall be taken at half hour intervals, and further adjustments or corrections made as required to obtain uniform temperatures. All occupied spaces shall be checked for drafts and noises and any unsatisfactory conditions corrected.
F. Balancing shall be performed during normal project working hours when project construction foreman is present on the job site to provide access and see his mechanical sub contractor is available to operate system and make necessary corrections.
G. Agency shall be represented at final inspection prepared to spot balance system or systems selected by Architect. Where spot balance does not match report. Entire system shall be rebalanced in presence of Architect's Mechanical Engineer at no additional cost to Owner or A/E team.

3.3 STANDARDS:

A. Balance shall be preformed in complete accordance with the following standards as applicable to the agency certification:
   1. HVAC Systems Testing, Adjusting, and Balancing, SMACNA 1983.
   2. Testing, Balancing, and Adjusting of Environmental Systems, SMACNA 1974.
   3. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, NEBB 1983.
   4. AABC National Standards, Fourth Edition 1982.
   5. Procedural Standard for Measuring Sound and Vibration, NEBB 1977.

B. Balancing Agency's National Certification shall warrant the system balance and performance. A copy of guarantee certificate shall be included in each test and balance report.

3.4 TESTING PROCEDURE:

A. Air Balance & Testing Agency shall perform following tests and balance system in accordance with following requirements:
B. Test and adjust blower rpm to design requirements.
C. Test and record motor full load amperes.
D. Make Pitot Tube tranverse of main supply and obtain design cfm.
E. Test and record system static pressures, suction, and discharge.
F. Test and adjust system for design cfm air.
G. Test and adjust system for design cfm outside air.
H. Test and record entering air temperatures (db heating and cooling).
I. Test and record entering air temperatures (wb cooling).
J. Test and record leaving air temperatures (db heating and cooling).
K. Test and record leaving air temperatures (wb cooling).
L. Adjust main supply and return air ducts to proper design cfm, + or - 5%.
M. Adjust zones to proper design cfm, supply and return, + or - 5%.
N. Test and adjust each diffuser and grille to design requirements. Individual air outlets, when one of three or more are serving one space, may have a tolerance of 10% from the average.
O. Identify each diffuser and grille as to location and area served.
P. Identify and list size, type, and Manufacturer of diffusers, grilles and testing equipment. Use Manufacturer's rating on equipment to make required calculations.
Q. In readings and tests of diffusers and grilles include required cfm and fpm velocity & test cfm and fpm after adjustments.
R. In cooperation with Section 15 900, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
S. Adjust diffusers and grilles to minimize drafts.

3.5 EXHAUST AIR SYSTEMS:

A. Systems are to be adjusted to same tolerance as supply systems. Each space is to be checked to see that it is positive, neutral or negative as indicated by quantities of supply and exhaust air shown on contract documents. Any

discrepancies shall be investigated and corrected, and the proper pressure relationship established.

B. Building pressure shall be checked at outside doors, relief air damper adjusted as required to leave building neutral or under slight positive pressure.

3.6 REPORT

A. Report shall include:

1. Record test data on AABC standard forms or facsimile thereof.
2. A set of black and white or blue line prints with all air openings marked to correspond with data sheets and with temperature clearly marked.
3. Show on final report the percent of design CFM to the actual CFM of each diffuser represents.
4. The certified report shall include for each air handling system the data listed below:

a) Equipment

1) Installation data

a] Manufacturer and model
b] Size
c] Arrangement, discharge, and class
d] Motor hp, voltage, phase, cycles, and full load amps
e] Location and local identification data

2) Design data

a] Data listed in schedules on drawings and specifications.

3) Fan recorded (test) data

a] cfm
b] Static Pressure
c] rpm
d] Motor operating amps
e] Motor operating bhp

b) Duct systems

1) Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust.

a] Duct size(s)
b] Number of Pitot tube (pressure) measurements.
c] Sum of velocity measurements (Note: Do not add pressure measurements)
d] Average velocity
e] Recorded (test) cfm
f] Design cfm

2) Individual air terminals

a] Terminal identification (supply or exhaust, location and number designation)
b] Type size, manufacturer and catalog identification

c] Applicable factor for application, velocity, area, etc., and designated area
d] Design and recorded velocities - fpm
e] Design and recorded quantities - cfm
f] % of design recorded quantity- cfm represents

END OF SECTION 15960

SECTION 15990 - FINAL TEST RUN

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.2 QUALITY CONTROL:

A. Final inspection will not be scheduled till all tests are done and O & M's submitted.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURE:

A. Contractor shall make a test run with all equipment operating continuously at design conditions for a period of 2 days or longer as necessary to demonstrate the system fulfills all requirements and operates satisfactorily. Contractor shall notify Architect in writing when he is ready to begin test. Contractor shall provide manpower to run test and operate equipment as may be required during test run. Contractor shall be responsible for all equipment during this test. The test shall run 24 hours per day with temperature control system resetting temperatures for night-day and weekends as specified.

B. Neither the final inspection nor the final payment shall be made to the Contractor until the heating, ventilation and cooling systems operational tests have been completed, balancing reports submitted, and Owner and Architect satisfied.

C. Operating tests of the heating system shall be made during the winter season of the first year of operation at times directed, for the proper setting and adjusting of the controls under peak load conditions.

D. Air Conditioning Systems: Operating test of the completed air conditioning systems shall be made during the summer season of the first year of operation at times directed. Each system shall be operated for periods of 6 hours minimum; test for air flow and temperature, to demonstrate compliance with required plans and specifications.

E. Recalibrate fresh air, return air and mixed air controls in areas effected by the renovation.

F. Furnish copies of test data, computation, results, as directed.

G. Applicable requirements under air conditioning tests shall govern similar work in heating, unless otherwise specified.

H. Temperature Controls: Manufacturer of automatic controls shall regulate and adjust thermostats, and other controlling devices; he shall place control systems in satisfactory operating conditions; he shall also instruct assigned operating personnel in operation and maintenance of these controls. Furnish diagrammatic

layouts of automatic control systems, and two sets of printed instructions for Owners operation and maintenance charts.

I. When final adjustments have been made, temperature readings shall be taken at a minimum of half hour intervals for a three hour period minimum. All damper positions shall be marked and access covers replaced.

END OF SECTION 15990

Camp W.G. Williams
Building 5080
DFCM #07332480

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SECTION 16000 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section and all other Division 16 specification sections.

B. This section applies to all Division 16 specification sections.

1.2 SUMMARY

A. This section includes general administrative and procedural requirements for electrical installations to expand the requirements of the General Conditions and Division 1 Specification Sections.

1.3 STANDARDS

A. The following industry standards are considered minimum requirements for electrical work and are made a part of the contract documents:

1. National Electrical Code, 2008 Edition (NEC)
2. Electrical Ordinances of Local Governing Authority
3. Utah State Fire Marshal's Rules and Regulations
4. International Building Code
5. International Fire Code
6. Underwriters Laboratories (UL) Standards
7. American National Standards Institute (ANSI)
8. National Electrical Manufacturer's Association (NEMA)
9. National Fire Protection Association (NFPA) Standards
10. Regulations of American Standards Association

B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Architect promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Architect.

1.4 WORKMANSHIP

A. All Electrical Work of any nature shall be performed by qualified electricians, experienced in the type of work to be performed and licensed with the State of Utah. Electricians shall show their license upon request of the Owner, Architect and/or their representatives.

1.5 FEES AND PERMITS

A. Obtain all necessary fees, permits and inspections in accordance with the General Conditions and Division 1 Specifications. Coordinate requirements with the General Contractor.

1.6 INSPECTIONS

A. Coordinate with DFCM Project Manager and General Contractor for required Code Inspections.

1.7 ELECTRICAL WORK INCLUDED

A. The basic contract work includes all labor, material, tools, transportation, equipment, and superintendence specified, indicated on the drawings or necessary to make a complete installation of, but not limited to, the following:

1. Appliances, apparatus and materials not specifically noted on drawings or mentioned herein, but which are necessary to make a complete working installation of all electrical systems required for the project.

2. Hangers, anchors, sleeves, chases, supports and fittings as may be required and as indicated.

3. Complete electric service with service transformers, cables, conduits, conductors, metering, distribution system, branch panels and branch circuits for power and lighting with raceway system and outlet boxes.

4. All luminaries, wall switches, receptacles, etc. as indicated on drawings.

5. Exterior building lighting and controls.

6. Fire alarm system, complete with all equipment in operative condition.

7. Telephone/Data outlets, raceway system, telephone service cables, fiber optic service cables, cable splices, and cable terminations and testing.

8. Electrical service to food service equipment.

9. Electrical service to heating, ventilating and air conditioning equipment.

10. Safety switches and other wiring necessary to connect electric power to the controls of heating, ventilating and air conditioning equipment.

1.8 SUBSTITUTIONS

A. Material or products specified by name of manufacturer, brand or trade name or catalogue reference will be the basis of the bid and furnished under the contract unless changed in writing by the Architect. Where two or more materials are named, the choice of these will be optional with the Contractor.

B. Submit requests for substitution in writing to the Architect with copy to Consulting Engineer, in accordance with the General Conditions.

1.9 ACCURACY OF DATA

A. Data given herein and on the drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Specifications and drawings are for the assistance and guidance of the Contractor.

B. Electrical drawings are diagrammatic, but will be followed as closely as building construction and work of other contractors will permit. All deviations from the drawings required to make the Electrical Work conform to the building as constructed and to the work of other contractors will be made by the Contractor as approved by the Architect.

1.10 VISIT THE SITE

A. Contractors are assumed to have visited the site and thoroughly acquainted themselves with conditions affecting the proposed work. Verify existing conditions and measurements at the building before beginning work and immediately notify the Architect of any discrepancies which may adversely affect completion of the work.

1.11 TEMPORARY POWER

A. Provide temporary power for reasonable convenience during construction in accordance with the General Conditions.

B. Provide GFCI Protection for all temporary power outlets.

C. Use temporary power for construction purposes only. Do not use temporary power for electric space heating, etc..

1.12 SHOP DRAWING SUBMITTALS

A. As soon as possible after contract award, submit shop drawings for review in accordance with the General Conditions and Division 1 Specifications.

B. Submit shop drawings in three ring loose-leaf binder.

C. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, starters, etc.. Provide a complete equipment list at the beginning of each subsection.

D. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for the following items:

1. Wiring Devices and Occupancy Sensors
2. Pad Mount Distribution Transformers
3. Fused Cutouts and Fuses
4. Distribution Surge Arresters
5. Medium Voltage Cable and Terminations
6. Meter/Main Breaker
7. Watthour Demand Meter
8. Safety Switches
9. Panelboards
10. Motor Starters
11. Light Fixtures
12. Fire Alarm System
13. Telecommunication System

E. Above list is considered minimum. Additional items may be required to be submitted for review.

F. Refer to individual Specification Sections for additional Shop Drawing Submittal requirements.

1.13 RECORD DRAWINGS

A. Provide As-Built Record Drawings in accordance with the General Conditions and Division 1 Specifications.

B. Indicate location and routing of all underground raceways on the As-Built Record Drawings by dimension to permanent structures such as buildings, sidewalks, curbs, etc.

C. Indicate all changes made to the drawings such as changes in fixture and outlet location, changes in circuit routing and circuit numbering, etc. Include all changes by Addenda, Change Order, Supplemental Instruction or verbal instruction.

D. Refer to individual Specification Sections for additional Record Drawing requirements.

1.14 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications.

B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.

C. All copies of literature will be new, clean and clearly legible. Sheets used for shop drawing submittals with review stamp, remarks, etc., will not be acceptable.

D. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, starters, etc.. Provide a complete equipment list and recommended maintenance schedule at the beginning of each subsection.

E. Refer to individual Specification Sections for additional Operation and Maintenance Manual requirements.

1.15 WARRANTY

A. Provide Warranty for Electrical Work in accordance with the General Conditions and Division 1 Specifications.

B. Provide manufacturer's warranty for all equipment which the manufacturer normally provides a warranty in excess of twelve months. Refer to individual Specification Sections for extended warranty requirements.

1.16 EXTRA MATERIAL STOCK

A. Provide extra stock in original cartons, or packaged with protective coverings, for storage and identified with labels clearly describing contents.

B. Turn over extra stock to Owner and place in storage prior to Substantial Completion. Exact location of storage to be determined by the Owner.

C. Obtain signed receipt for extra stock materials from the Owner's Project Manager. Include copy of signed receipt in the Project Operation and Maintenance Manuals.

D. Provide the following extra stock of materials to the Owner.

1. Fuses: refer to Specification Section 16440 - Fuses for required quantities.

2. Fixture lenses, louvers, diffusers, and lamps: refer to Specification Section 16500 - Lighting for required quantities.

3. Fire Alarm System Components: refer to Specification Section 16720 - Fire Alarm System.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and equipment for which U.L. Standards have been established, will be listed by and bear the label of Underwriters Laboratories, Inc..

B. All materials will be new and bear the manufacturer's name, trade name and catalog or model numbers. Similar items will be of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of materials will comply with all codes and be accomplished with good workmanship in the judgement of the Architect and Consulting Engineer.

3.2 COOPERATION WITH OTHER CONTRACTORS

A. Cooperate with other contractors doing work on the building as may be necessary for the proper execution of the work of various trades employed in construction of the building.

B. Refer to architectural, structural, and mechanical drawings, for construction details, and coordinate the electrical work with that of other contractors to the end that unnecessary delays and conflicts will be avoided.

3.3 MATERIAL HANDLING

A. Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

3.4 CUTTING AND REPAIRING

A. Provide all required digging, cutting, etc. incidental to the Electrical Work. Make required repairs thereafter to the satisfaction of the Architect.

B. Do not cut into any major structural element, beam or column, without written approval of the Architect.

C. Install the Electrical Work to proceed with other trades in order to avoid unnecessary cutting of the construction.

3.5 CONSTRUCTION REVIEW

A. The Owner, Architect and/or Consulting Engineer will perform construction review throughout the construction of the project. The construction review does not relieve the contractor from the responsibility of providing all materials and performing the work in accordance with the Contract Documents.

B. Notify the Architect in writing, giving ample notice, at the following stages of construction and allow the Owner, Architect and/or Engineer to review the installed work.

1. When underground electrical work is complete, before backfilling, including work under floor slabs.
2. When all electrical rough-in is complete, but not covered.
3. Pre-Final, upon completion of all electrical work.
4. Final, upon completion of all items noted in the Pre-Final Construction Review Report.

C. Prerequisite for Final Electrical Construction Review:

1. Electrical Engineer/Consultant must be present.
2. Electrical Contractor's job foreman must be present.
3. DFCM Representative must be present.
4. Service Disconnect and all Panelboard Enclosures must be open.
5. Clear access must be provided to all devices and equipment.
6. All panels, disconnects, etc. must be labeled and typed panel index cards installed.
7. All light fixtures, outlets, equipment, etc., must be energized and operable.
8. Contractor must have pad and pencil to list all deficient items.
9. Make all corrections and adjustments after the Final Construction Review, not during. Items requiring correction will appear on the Final Construction Field Report.
10. Contractor must have all required keys to provide access to all panels and doors.

D. Test all systems and equipment provided and/or connected under the Contract for short circuits, ground faults, proper neutral connections and proper operation in the presence of the Owner, Architect and/or Engineer.

E. The entire construction will be installed in accordance with the contract documents and be free of mechanical and electrical defects prior to final acceptance of the work.

* END OF SECTION 16000 *

SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Division 1 Demolition Sections.

1.2 SCOPE

A. Remove electrical equipment and wiring systems and make required extensions and reconnections as shown on Drawings and specified herein.

B. Repair all damage resulting from demolition and extension work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide new materials and equipment for patching and extending work as specified in the appropriate Specification Section for the materials and equipment involved.

B. Where materials or methods not included in the Specifications are required, provide materials and methods in accordance with normal construction industry standards and as approved by the Architect and/or Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify existing measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on field observation of existing surface conditions. Report discrepancies to Owner and/or Architect before disturbing existing installation.

D. All demolition and extension work is not necessarily indicated on Drawings. Include all such work without additional cost to Owner.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Owner.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use electricians experienced in such operations.

D. Protect all existing electrical equipment to remain from damage during demolition and new construction. Survey all existing equipment prior to beginning work and document in writing any existing damage to existing equipment.

3.3 DEMOLITION

A. Coordinate with Owner for equipment and materials to be removed by Owner or salvaged by the contractor for Owner. Place salvaged equipment and materials in storage at the project site as directed by the Owner.

B. Legally dispose of all removed equipment and materials not salvaged for the Owner.

1. Existing fluorescent lamp ballasts are assumed to be free of PCBs. The contractor shall verify that ballasts are free of PCBs with the ballast manufacturer prior to disposal. Any additional cost for hazardous material disposal will be negotiated under the change order provisions of the contract, or the Owner will assume responsibility for legal disposal of the ballasts.

C. Remove abandoned wiring to source of supply, i.e. panelboard, circuit breaker, etc..

D. Remove accessible abandoned conduit, cables, junction boxes, etc., including above accessible ceilings. Cut conduit flush with walls and floors.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes and conduit servicing them where indicated on drawings. Provide blank cover for abandoned outlets which are not indicated to be removed.

3.4 EXTENSION OF EXISTING ELECTRICAL WORK

A. Reconnect existing equipment where demolition interrupts existing branch circuits or feeders to the equipment.

B. Repair adjacent construction and finishes damaged during demolition and extension work to match surrounding surfaces.

C. Extend existing installations using materials and methods as specified for new work. Remove and replace existing installations which are not compatible with new work.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.6 INSTALLATION

A. Install relocated materials and equipment as required for new materials and equipment.

3.7 OUTAGES

A. Maintain Existing Electrical Systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and connections. Minimize outage duration.

B. Obtain permission from Owner before partially or completely disabling systems in accordance with Division 1 Specification Sections.

* END OF SECTION 16060 *

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide a complete raceway system for all wiring as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Provide minimum 3/4" trade diameter raceways for all wiring systems.

1. Minimum 1/2" trade diameter raceways may be used for remote control, signaling and power-limited circuits which meet the requirements of National Electrical Code Article 725 as allowed in other Specification Sections and/or as approved by the Architect.

B. Do not use aluminum conduit, intermediate steel conduit (IMC), BX cable, MC cable, Flexible Non-metallic Tubing, NM cable, Direct Burial Cable or any other wiring methods not allowed by this specification unless approved in writing by the Architect and/or Engineer.

2.2 ABOVEGROUND RACEWAYS

A. Provide Electrical Metallic Tubing (EMT), galvanized inside and out, for raceways not subject to permanent moisture or damage.

B. Provide Galvanized Rigid Steel Conduit (GRC) where raceways are subject to permanent moisture such as underground, or damage such as vehicular traffic, etc..

2.3 UNDERGROUND RACEWAYS

A. Provide Schedule 40 PVC electrical conduit in earth or in concrete in contact with earth.

1. Provide a separate ground wire in all PVC conduits, except main electrical service conduits.

2. Provide Galvanized Rigid Steel Conduit (GRC) for all bends greater than 45 degrees in PVC conduits runs.

3. Do not use PVC conduit above grade nor for penetrations through structural elements such as foundation walls, floor slabs, etc..

B. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through floor slab or grade to extend minimum 12" above floor or grade.

C. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through foundation walls to extend minimum 36" beyond the foundation wall.

D. Corrosion protect all galvanized rigid steel conduit (GRC) installed in earth or in concrete in contact with earth with two (2) half-lapped layers of 0.010" thick approved waterproof PVC tape equal to Scotch No. 50 or use factory PVC coated rigid steel conduit with all field joints coated after installation.

2.4 FLEXIBLE RACEWAY CONNECTIONS

A. Provide Flexible Steel Conduit for final connection to lay-in light fixtures, motors and other equipment subject to vibrations or movement, not to exceed 6 feet for fixture connections and 3 feet for motor and equipment connections.

B. Provide liquid-tight flexible steel conduit outside and in wet, humid, corrosive and oily locations.

1. Provide Sunlight Resistant liquid-tight flexible steel conduit outdoors.

C. Provide a ground conductor in all flexible steel conduit.

D. Flexible Steel Conduit may be used where misalignment or cramped quarters exist only with prior approval of the Architect and/or Engineer.

E. Minimum 1/2" flexible steel conduit or 3/8" factory fabricated fixture whips may be used to make final connections to lay-in light fixtures.

F. Flexible Steel Conduit may be used to fish through existing walls and ceilings only with prior approval of the Architect and/or Engineer.

2.5 CONDUIT FITTINGS

A. Provide steel compression type or steel set screw type fittings for Electrical Metallic Tubing.

B. Provide malleable iron clamp type fittings for Flexible Steel Conduit.

C. Provide steel compression type fittings for Liquid-Tight Flexible Steel Conduit.

D. Provide threaded fittings for GRC conduit. Provide double locknuts and plastic bushing for GRC conduit terminations or provide boxes and enclosures with threaded hubs.

E. Provide liquid-tight and gas-tight conduit fittings underground using fittings and PVC cement as recommended by the conduit manufacturer.

F. Provide steel rain-tight, compression type fittings for all conduit installed outside and in wet, humid, corrosive and oily locations.

G. Provide Insulated Throat Connectors for all conduit terminations 1" diameter and smaller. Provide insulating bushings for all conduit terminations 1-1/4" diameter and larger.

H. Provide Grounding Bushings bonded to the electrical system ground:

1. On each end of all service conduits.

2. On each end of all feeder conduits in which a separate ground conductor is installed.

3. On each end of all conduits used to protect ground conductors.

4. On all conduit terminations installed in concentric or eccentric knockouts or where reducing washers have been installed.

I. Do not use cast metal or indenter type fittings. Do not use screw-in type fittings for Flexible Steel Conduit. Do not use spray (aerosol) PVC cement.

2.6 RACEWAY SEALS

A. Seal all conduit penetrations through fire rated walls, ceilings and floors with a UL classified fire barrier system [in accordance with Division 7 Specification Requirements.

B. Seal all conduit penetrations through airtight spaces and plenums with an approved mastic compound acceptable to the Architect to prevent air leakage.

2.7 ROOF PENETRATIONS

A. Provide Galvanized Steel or Lead roof jacks of suitable style and material for all conduit penetrations through roof to provide a weathertight seal in accordance with the applicable Roofing Specification Sections. Coordinate style, material and installation with the roofing contractor.

2.8 PULL BOXES

A. Provide pull boxes or conduit bodies in accessible locations where required to reduce the number of bends in the conduit run to less than 360 degrees and at points not exceeding 100 feet in long branch circuit conduit runs.

1. Indicate exact location of pull boxes and conduit bodies on the As-Built Record Drawings.

2.9 PULL STRING

A. Provide a nylon or polypropylene pull string with not less than 200 lb tensile strength in all spare conduits and conduits installed for use by others. Provide a hard cardboard tag for each raceway to indicate location of the opposite end of the raceway.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Securely support all raceways with full (2 hole) pipe straps, hangers, or ceiling trapeze directly from building structure such as roof trusses, beams, floor joists, etc., in accordance with Specification Section 16190 - Supporting Devices.

1. Do not support raceways from other electrical systems or mechanical systems.

B. Provide supports at 5'-0" on center with a minimum of two supports for each ten foot length of conduit or fraction thereof up to 6 feet.

C. Provide a support within 12" of each coupling, fitting, box, enclosure and bend.

1. Install supports at vertical to horizontal conduit bends on the upper side of the bend.

D. Provide support method for parallel conduit runs as follows:

No. of Conduits	3/4" to 1-1/4" Conduits	1-1/2" and larger Conduit
2	Full Strap, Clamp or Hanger	Mounting Channel
3 or More	Mounting Channel (Trapeze)	Mounting Channel

3.2 INSTALLATION

A. Raceway layouts on the drawings are generally diagrammatic and the exact routing of raceways will be governed by structural conditions and the work of other contractors.

B. Install raceways concealed within finished ceilings, walls and floors except where exposed raceways are specifically shown on the drawings or permitted by the Architect.

C. Install exposed raceways parallel with or perpendicular to walls and ceilings, with right angle turns consisting of symmetrical bends or conduit bodies equal to Crouse-Hinds "Condulet". Avoid all bends and offsets where possible.

1. Paint exposed raceways to match surrounding surfaces in accordance with Division 9 Specification Sections, except raceways in unfinished areas such as mechanical rooms and electrical rooms will not be required to be painted.

D. Install raceways minimum 12" from insulation of hot water piping, steam piping and other systems or equipment with temperatures in excess of 104^0 F (40^0 C).

E. Make all field bends and offsets with a radius not less than allowed by the National Electrical Code for the type of raceway system.

1. Do not install bends or offsets which are flattened, kinked, rippled or which destroy the smooth internal bore or surface of the conduit.

F. Cap the open ends of raceways during construction to prevent the accumulation of water, dirt or concrete in the raceways. Thoroughly clean raceways in which water or other foreign matter has been permitted to accumulate or replace the raceway where such accumulation cannot be removed by a method approved by the Architect and/or Engineer.

G. Do not install raceways which have been crushed or deformed in any manner.

H. Do not install wiring until work which might cause damage to the wires or raceways has been completed.

3.3 UNDERGROUND RACEWAY INSTALLATION

A. Install underground raceways within buildings minimum 4" below the bottom of the concrete floor slab to the top of the raceway.

B. Install underground raceways outside of building minimum 24" below finished grade to the top of the raceway for low voltage raceways and 36" below finish grade to top of concrete encasement for medium voltage raceways.

1. Provide a plastic red magnetic warning ribbon stating "CAUTION - BURIED ELECTRICAL" 12" directly above the top of the raceway.

C. Use select granular fill, free of rocks or hard clumps with sharp or angular edges, for the first 6" of backfill around underground raceways including raceways below concrete floor slabs. Provide imported sand backfill where required by Division 2 Specifications or where excavated materials are not suitable.

D. Secure underground raceways in place prior to pouring concrete encasement by means of duct spacers spaced at points not more than 5'-0" on center. Spacers shall maintain spacing of raceways as indicated on the drawings.

E. Coordinate location of underground raceways with the General Contractor to avoid areas where raceways may be damaged by subsequent installation of other underground utilities.

F. Install underground raceways minimum 3'-0" from parallel runs, and minimum 1'-0" from perpendicular runs, of underground natural gas and propane lines.

G. Do not use torches to heat PVC conduit for field bends. Do not install PVC conduit that has been scorched by heating for bends.

* END OF SECTION 16110 *

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all conductors for power and lighting as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Provide Copper building wire, minimum #12 AWG, with type THHN/THWN or XHHW 600 volt insulation, except as otherwise noted on the drawings or required by NEC.

1. Provide conductors in underground raceways with insulation approved for wet locations such as type THWN or XHHW.

B. Provide stranded conductors for wires #8 AWG and larger and for terminal connections to all motors. Stranded or solid conductors may be used for sizes smaller than #8 AWG at the contractor's option.

C. Provide conductors rated 90^0 C minimum in wiring channels of Fluorescent and High Intensity Discharge lighting fixtures.

D. Provide conductors with surface printed identification showing conductor size and material, insulation type, voltage rating and approvals at regularly spaced intervals of 24".

E. Do not use sizes smaller than #12 AWG in branch circuits carrying load. Circuits requiring larger sizes to meet voltage drop conditions, etc., are indicated on the drawings.

1. Where branch circuit homeruns indicate conductor size, use that size conductor for the entire branch circuit, including switch legs, etc.

F. Do not use aluminum conductors.

2.2 SPLICES

A. Provide Ideal wirenuts or Scotchlock spring connectors for all conductor splices #8 AWG and smaller. Provide split-bolt or compression type connectors for all conductor splices larger than #8 AWG.

B. Provide splices which are UL listed for the type, quantity and size of the conductors to be spliced.

C. Provide all splices with insulation at least equal to that of the conductor.

D. Provide watertight splices in junction or outlet boxes located outside and in wet locations. Provide heat shrink insulating kits or use connectors pre-potted with an approved waterproof compound.

E. Splice conductors only in approved boxes.

F. Do not splice conductors in conduit bodies, panelboard enclosures, switchboard enclosures, or similar locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all conductors in approved raceway systems.

B. Install branch circuit conductors continuous without splice from panelboards to fixture outlet boxes, device terminals, etc..

1. Provide suitable pull boxes in readily accessible locations where necessary at intermediate points of branch circuits. Indicate exact location of all boxes on the As-Built Record Drawings.

C. Do not install wiring until work which might cause damage to the wires has been completed.

3.2 COLOR CODING AND IDENTIFICATION

A. Color code all wiring at each enclosure and box where conductors are accessible and at each splice, tap or termination by means of colored conductor insulation.

1. For conductors #6 AWG and larger, colored self-adhesive tape with the appropriate color designations may be used.

B. Color code each conductor of each circuit as follows.

1. Ground: Green or Bare Copper

2. 120/208 Volt, 3 Phase, 4 Wire System
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White

C. Color code switch legs and travelers according to phase with colors other than used for phase conductors, to be consistent throughout the project.

3.3 IDENTIFICATION

A. Provide conductor identification in accordance with Specification Section 16195 - Electrical Identification.

3.4 MULTI-WIRE BRANCH CIRCUITS

A. Where a common neutral is run for multi-wire branch circuits, connect phase conductors to separate phases such that the neutral conductor will carry only the unbalanced current. Use neutral conductors of the same size as the phase conductors unless specifically noted otherwise.

1. Provide UL Listed circuit breaker handle ties to simultaneously disconnect all circuits of multi-

wire branch circuits as required by NEC 210.4 (B) or provide a separate neutral for each branch and identify each neutral conductor in accordance with Specification Section 16195 - Electrical Identification.

B. Do not install more than three phase conductors in any raceway except where specifically shown on the drawings or approved by the Architect and/or Engineer.

3.5 PHASE ROTATION

A. Phase rotation for Three Phase System will be A leads B Leads C from front to back, from left to right or from top to bottom as viewed from the front of the enclosure.

* END OF SECTION 16120 *

SECTION 16130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide junction boxes and outlet boxes at each outlet, fixture and other device location as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 OUTLET AND DEVICE BOXES

A. Provide galvanized or cadmium plated sheet steel electrical boxes in indoor dry locations, of the most suitable size and shape for the conditions encountered and in accordance with NEC requirements for the number of conductors allowed.

B. Provide minimum 4" Square or Octagonal, 1-1/2" Deep Boxes unless specifically indicated otherwise on the drawings.

1. Provide minimum 4" Square or Octagonal, 2-1/8" Deep Boxes where Three (3) conduit connections are required.

2. Provide minimum 4-11/16" Square, 2-1/8" Deep Boxes where Four (4) or more conduit connections are required.

3. Provide gang boxes where more than one device is located at the same point.

4. Boxes smaller than 4" Square or Octagonal, even though of equivalent cubic inch capacity, are not acceptable.

C. Provide Type FD cast metal boxes outside, in wet, humid or corrosive locations and where exposed to damage such as vehicular traffic.

D. Confer with the various equipment suppliers and either use or properly provide for boxes which are furnished with the equipment, such as speakers, horns, bells, etc..

E. Do not use "THRU-THE-WALL" boxes, sectional (gangable) boxes or non-metallic boxes.

2.2 JUNCTION BOXES

A. Provide junction boxes as specified for outlet and device boxes except that boxes 6" square and larger may be painted sheet steel.

2.3 BOX ACCESSORIES

A. Provide fittings, plaster rings, cover plates and other accessories suitable for the purpose and location of each box.

B. Provide plaster rings which are minimum 1/8" deeper than wall covering for flush mounted boxes (i.e. use 3/4" plaster ring for 5/8" gypsum board wall covering) such that plaster ring will be flush with finished face of wall.

C. Provide industrial raised covers for surface mounted outlet and device boxes.

D. Provide masonry rings for boxes installed in brick walls, concrete block walls and in walls with tile finish.

E. Provide ceiling outlet boxes with standard 3/8" fixture stud where required for fixture to be installed.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Support each box from the building structure independent of the raceway system.

B. Support flush mounted wall boxes with metal bar hangers or metal stud backing behind the box secured to wall studs.

C. Support flush mounted ceiling boxes with metal bar hangers secured to ceiling support system or threaded rod hangers secured to structure.

1. Secure boxes for box supported fixtures to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater.

D. Secure surface mounted boxes to building structure with minimum of 2 screws or bolts as required.

E. Do not use side mounted boxes or brackets.

3.2 INSTALLATION

A. Install flush mounted boxes, after being equipped with extensions, accessories, etc., flush with finished face of wall, ceiling or floor.

1. Replace or repair all boxes not installed flush with finished surfaces to the satisfaction of the Architect and/or Owner.

2. In order to meet this requirement, it is recommended that the Electrical Contractor be present during installation of gypsum board, tile or other wall coverings and during installation of outlet boxes in masonry walls.

3. Coordinate depth of wall coverings to be installed on all walls with the General Contractor prior to installing plaster rings.

B. Install boxes in opposite sides of common room walls in adjacent stud spaces where possible and with minimum 6" separation between the boxes. Provide minimum 10" of conduit between boxes which are connected by conduit.

C. Install outlet boxes for light switches on the strike side of door openings. Coordinate door swings with the General Contractor prior to roughing in switch boxes.

D. Seal around the surface of all switch and outlet boxes with plaster or grout to close any opening between the outlet box and the wall finish.

E. Install boxes level and plumb.

3.3 LOCATIONS

A. The wiring system layouts on the drawings are generally diagrammatic and the location of outlets and equipment are approximate.

B. Study all available drawing details, shop drawings, equipment drawings, building conditions and materials surrounding each outlet and device box prior to installing the box to ascertain the exact location required for each box.

C. Rough in the electrical work such that electrical outlets, fixtures and other fittings are properly fitted to the work of other trades.

D. Do not install boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.

E. The right is reserved to make any reasonable change in the location of the outlets before roughing in, without involving additional expense.

3.4 MOUNTING HEIGHT

A. Install outlet and device boxes at the heights shown on the drawings or as directed by the Architect. In general, mount outlets as follows.

1.	Convenience Outlet	18"
2.	Wall Switch	46"
3.	Bracket Light	7'-0"
4.	Telephone/Data Outlet	18"
5.	Special Purpose Receptacle	18"
6.	Fire Alarm Pull Station	46"
7.	Fire Alarm Horn/Strobe	84"
8.	Exit Lights	8'-0"

B. All mounting heights, including mounting heights indicated on drawings, are to the center of the outlet box above finished floor or grade unless noted otherwise.

C. Install outlets above counters 4" above the top of the counter backsplash to the center of the outlet. Coordinate mounting heights with the cabinet installer prior to roughing in the outlets.

D. Refer to applicable Specification Sections for mounting heights of devices and equipment not included above or install at heights as directed by the Architect and/or Engineer.

* END OF SECTION 16130 *

SECTION 16140 - OUTLETS AND WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all wiring devices complete with coverplates and necessary accessories as shown on the drawings and as specified herein.

1.3 SUBMITTALS

A. Provide submittals for each type of wiring device to be used on the project in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the contract documents.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. Provide wiring devices rated 20 amps minimum, as specified below, or equivalent of Eagle, General Electric, Hubbell, Leviton or Pass & Seymour.

1.	Switch, Single Pole	Bryant 4901
2.	Switch, 3 - Way	Bryant 4903
3.	Receptacle, duplex convenience, 3-wire	Bryant 5352
4.	Receptacle, duplex, GFCI protected	Bryant GFR53FT
5.	Special Purpose Receptacles of NEMA Configurations designated on the drawings.	

B. Color of devices in finished areas will be as selected by the Architect from the manufacturer's standard colors to compliment the color of architectural finishes.

C. Provide convenience outlets with GFCI protection in accordance with NEC requirements, where installed outside or within 6 feet of any sink and as indicated on the drawings.

1. Provide a self-adhesive printed label stating "GFCI PROTECTED" for each outlet protected by feed-through GFCI receptacles or GFCI circuit breakers.

2. Use feed-through GFCI outlets only to protect other outlets within sight of the GFCI protected outlet.

2.2 COVERPLATES

A. Provide a cover plate for each outlet and box suitable for the location and function of the outlet and box.

B. Provide blank cover plates for junction boxes and outlet boxes not used.

C. Provide nylon or impact resistant thermoplastic coverplates for outlets and boxes installed in

finished areas, of the same manufacturer and color as the wiring devices.

D. Provide Stainless Steel coverplates for outlets and boxes installed in unfinished areas such as mechanical and electrical rooms.

E. Provide UV Stabilized Polycarbonate, "Raintight While In Use" coverplates with spring return lids and suitable gasket as manufactured by Eagle or Taymac for all devices installed outside or in wet locations.

2.3 OCCUPANCY SENSORS

A. Provide ultrasonic type occupancy sensors, as specified below, to control lighting in rooms as indicated on the drawings.

B. Provide ultrasonic type occupancy sensors, as specified below, to control lighting in rooms as indicated on the drawings.

1. 180^0 Ceiling Sensor Novitas 01-072
   a. Nominal 1/2 step walk coverage, open area: 900 sq. ft. (30' x 30')
   b. Nominal motion at desk coverage, open area: 672 sq. ft. (24' x 28')

2. 360^0 Ceiling Sensor Novitas 01-083
   a. Nominal 1/2 step walk coverage, open area: 2,100 sq. ft. (36' x 60')
   b. Nominal motion at desk coverage, open area: 1,344 sq. ft. (24' x 56')

3. Switchpack Novitas 13-051
   a. 120/277 Volt field selectable circuit voltage rating.
   b. Contact ratings:
      (1) 15 Ampere, 120 VAC, Tungsten
      (2) 20 Ampere, 120/277 VAC, Ballast
   c. NEC Class 2, 15 VDC, control circuit for interface with motion sensors.
   d. Zero crossing circuit to ensure the relay contacts engage at the zero crossing point of the AC Voltage source to minimize contact damage due to high inrush loads such as tungsten lighting and electronic ballasts.

4. Wall switch Novitas 01-211
   a. Coverage suitable for use in offices or rooms up to 300 sq. ft.
   b. 120/277 Volt field selectable circuit voltage rating.
   c. Contact ratings:
      (1) 6.7 Amps, 120 VAC, Tungsten or Ballast. (Approximately 800 Watts)
      (2) 4.3 Amps, 277 VAC, Ballast. (Approximately 1,200 Watts)
   d. Automatic/Manual selector switch to allow automatic or manual operation of the room lighting. Lighting shall turn off automatically after the pre-set time delay in either the automatic or manual mode.

C. Other acceptable manufacturers, subject to compliance with the contract documents are Honeywell, Hubbell, Leviton, Lightolier, Pass & Seymour, Tork, Uneco and Watt Stopper.

1. Occupancy sensors of other acceptable manufacturers may be ultrasonic, passive infrared or dual technology ultrasonic & passive infrared.

2. Coverage areas indicated on the drawings are based on the use of the above specified Novitas ultrasonic occupancy sensors. Other acceptable manufacturers which require additional sensors for coverage areas indicated shall provide additional sensors without

additional cost to the Owner.

2.4 ACCESSORIES

A. Equip each outlet with devices suitable for the purpose of the outlet and with means of properly connecting the equipment served, whether or not such devices are specifically mentioned.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Properly locate each outlet to fulfill its particular purpose. Do not install receptacles or boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.

B. Install all outlets and wiring devices flush with face of coverplate, with the coverplate in contact with the finished face of the wall and with mounting strap of device in contact with the outlet box.

* END OF SECTION 16140 *

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide suitable supporting devices for all electrical equipment, raceways and components as specified herein and as shown on the drawings.

B. Refer to individual specification sections for additional supporting requirements.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Provide support anchors which will support in tension a minimum of 4 times the weight of the equipment to be supported but not less than 100 lbs.

B. Provide wood screws in wood; toggle bolts in hollow masonry units; expansion bolts with lead shield or shot anchors in concrete and brick; and machine screws, threaded 'C' clamps or spring-tension clamps on steel work.

C. Do not use tie wire for support unless specifically called for in individual specification sections.

D. Do not use threaded C Clamps on tapered steel sections.

E. Do not weld supports, equipment, boxes, raceways, etc., to steel structures.

F. Do not use wooden plugs or plastic inserts as a base for supports.

G. Do not use shot anchors or drilled anchors of any kind in prestressed or post-tensioned concrete slabs and beams except as approved in writing by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure supporting devices to building structure.

B. Do not install supporting devices with sheetrock or plaster as the sole means of support. Provide proper blocking behind the sheetrock or plaster as required to support equipment.

* END OF SECTION 16190 *

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide identification of all electrical equipment, devices, enclosures, conductors, cables, etc., as shown on the drawings and as specified herein.

B. Refer to individual specification sections for additional identification requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Provide engraved laminated micarta or plastic nameplates to identify each panelboard, cabinet, motor starter, disconnect, etc., with the following minimum lettering heights:

1. Panelboards, etc. - 3/8"
2. Disconnects, motor starters, etc. - 1/4"
3. Time switches, lighting contactors, etc. - 3/16"
4. Light Switches, Outlets, etc. - 1/8"

B. Provide Black Nameplates with White Lettering unless noted otherwise, or required to contrast with equipment enclosures.

C. Do not use Dynamo Labels, printed labels, etc., unless specifically called for in other specification sections or approved by the Architect and/or Engineer.

2.2 EQUIPMENT IDENTIFICATION

A. Provide engraved nameplates on the exterior of each Motor Starter, Safety Switch, etc., to include the Equipment Description, Number or Designation, Voltage, Motor Horsepower and/or Full Load Amps and the Circuit from which the equipment is served.

1. Example: MAKE-UP AIR UNIT MA-1
   1-1/2 HP, 208 VOLT, 30
   CIRCUIT A2-31

B. Provide engraved nameplates on the exterior of feeder and other major junction boxes and pull boxes to indicate the function of the wiring within the box such as "PANEL 'A' FEEDER" or "FIRE ALARM PULLBOX".

2.3 PANELBOARD IDENTIFICATION

A. Provide one engraved nameplate on the exterior trim of each Panelboard, visible without opening the door, to include the Panel Designation and the System Voltage.

1. Example: PANEL 'A1'
   120/208 V, 3Ø

2.4 CONDUCTOR IDENTIFICATION

A. Identify each branch circuit and each feeder conductor at each outlet box, pull box, or other accessible location with hand lettering in black India ink in the enclosure to indicate panel and circuit numbers of all conductors in the enclosure.

B. Identify individual conductors with self adhesive printed markers equal to Thomas & Betts "E-Z Code" markers in outlet boxes, pull boxes, or other accessible location according to the circuit number in outlet boxes, pull boxes, etc., at the following locations:

   1. Where circuit number of individual conductors cannot be determined by color coding, such as two or more conductors on the same phase.

   2. Where more than one neutral conductor occurs, or where the neutral conductor is not common to all phase conductors, identify the neutral conductor according the associated phase conductor(s) circuit number(s).

2.5 PANELBOARD CIRCUIT INDEX

A. Provide a neatly typed index, to include type of load served and the specific location of the load for each branch circuit of each panelboard.

B. Examples

   1. Lighting, Southwest Conference Room
   2. Lighting, 2nd Floor Conf. Rm and Office 208
   3. Receptacles, SW Conf. Rm, west and north walls

C. Do not use room numbers shown on plans, use room numbers or nomenclature assigned to rooms by the Owner. Do not use remarks from panel schedules on drawing, the remarks are for the Contractor's reference only.

D. Include the panel designation and location of feeder breaker serving the panelboard at the top of the circuit index.

   1. Example: PANEL 'A'
      MAIN AT METER

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install nameplates to be visible from normal viewing angles.

B. Attach nameplates to equipment enclosures with stainless steel screws or rivets. Adhesives are not acceptable.

C. Install panel index behind protective plastic covering.

* END OF SECTION 16195 *

SECTION 16300 - PRIMARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16400 - Secondary Service & Distribution

1.2 SCOPE

A. Provide complete primary electrical service and distribution as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

A. The existing primary distribution system is 7,200/12,470 Volt, 3 Phase, 4 Wire, Grounded WYE primary distribution system.

B. New secondary service voltages will be as indicated on the drawings.

2.2 PRIMARY ELECTRICAL SERVICE

A. Provide new underground primary electrical service, complete from existing overhead primary power line to new building distribution transformers, located as shown on the drawings and as detailed in the Power Riser Diagram.

B. Provide for connection to future underground primary power distribution system as indicated on drawings. Coordinate requirements and schedule with Owner.

2.3 FEEDERS

A. Sizes and connection of feeders are shown on the Single Line Diagrams. Feeders are sized to handle rated loads and to meet voltage drop conditions.

B. Do not install conductors of different sizes or types in the same conduit except as specifically noted on the drawings.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate installation of electrical service with Owner and contractors doing work in buildings under construction prior to beginning work.

3.2 FEEDERS

A. Before or during final inspection, check each feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.3 POWER OUTAGES

A. Power outages to any portion of the existing Electrical Distribution System will not be allowed except on weekends, holidays and/or as directed by the Owner.

B. Submit requests for power outages to the Owner in writing, a minimum of Seven (7) days prior to all proposed outages. Indicate areas and buildings which will be affected by the power outage and the expected length of the power outage.

C. Do not take any power outages without the Owners written permission.

* END OF SECTION 16300 *

Camp W.G. Williams
Building 5080
DFCM #07332480

SECTION 16320 - PAD MOUNT DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide Pad Mounted, Oil-filled, Distribution Transformers as shown on drawings and as described herein.

1.3 STANDARDS

A. Provide new transformers constructed and tested in accordance with the latest revision of ANSI C57 12.00, C57 12.20 and C57.90 for; 750 KVA and below, High Voltage, 15,000 Volts and below; Low Voltage, 600 Volts and below.

B. Where NEMA and IEEE standards are established they shall also apply.

1.4 SUBMITTALS

A. Provide submittals for each transformer in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.

B. Include outline drawings indicating dimensions, location of external items, anchorage points, etc., for each transformer.

C. Include literature for each transformer to describe construction details, materials, ratings, etc., of the following:

1. Primary and Secondary Voltages
2. Primary voltage adjustment taps
3. KVA rating
4. Basic Impulse Level (BIL)
5. Core and windings
6. Tank construction and sealing system
7. Impedance
8. Full Load and No Load Losses
9. High Voltage Bush Wells
10. Low Voltage Bushings
11. Insulation
12. Insulating Oil
13. Nameplates
14. Accessories
15. Warranty

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide transformers manufactured by a member firm of NEMA who is regularly engaged in manufacturing transformers similar to those required for this project. Provide items substantially the same as items of manufacture which have been in successful use for not less than 5 years in projects and units of comparable size.

B. Acceptable manufacturers, subject to compliance with contract documents, are ABB, Cooper Industries, Cutler Hammer, General Electric, MGM, and Square D.

2.2 RATINGS

A.	Primary Voltage:	12,470Y/7,200 V, 3Ø, 4 W, Grd WYE
B.	Secondary Voltage:	208Y/120 V, 3Ø, 4 W, Grd WYE
C.	KVA Rating:	45 KVA
D.	Temperature Rating:	65^0 C above a 35^0 C ambient
E.	Basic Impulse Level (BIL):	95 KV
F.	Impedance:	Manufacturer's Standard

2.3 CONSTRUCTION

A. Provide compartmental type, self-cooled, tamperproof and weatherproof transformers for mounting on a pad which comply with applicable NEMA and ANSI standards.

B. Provide barrier between high voltage and low voltage compartments with separate doors for each compartment. Interlock doors to prevent access to the high voltage section unless the low voltage section door has first been opened.

1. Provide doors with 3 point latching mechanism and vault type handle with provisions for a single padlock. Provide door stops to hold doors open.

2. Provide grounding stud in each compartment.

3. Provide compartments sized to meet the requirements of ANSI C57.12.26.

C. Provide transformer tank construction that effectively seals the tank interior from the atmosphere but will allow entry for service.

1. Provide sealing system to maintain integrity of the seal over an operating oil temperature range of -25^0 C to 105^0 C.

2. Provide tank construction to withstand a minimum pressure of 7 PSI gauge without permanent distortion.

D. Provide core and winding material and construction to minimize transformer losses.

1. Core material may be either silicon steel or amorphous.

2. One piece core construction is desired. Provide minimum assembly joints, held together with bands and torqued bolts, where other construction is used. Crimped banding is not acceptable.

3. Provide 5 legged core construction with a separate high-voltage neutral bushing in the high-voltage compartment where a WYE-WYE, Three-Phase connection is indicated.

4. Windings shall be copper. Aluminum winding are not acceptable.

E. Provide each transformer with lifting provisions of adequate strength, size and arrangement to permit lifting the transformer in an upright position when filled with insulating fluid.

F. Provide each transformer with a durable corrosion resistant and scratch resistant outdoor finish meeting or exceeding EEI finishing requirements. Color shall be Olive Green, Munsell #7GY3.29/1.5.

2.4 HIGH VOLTAGE COMPARTMENT

A. Provide Loop-Feed dead front high voltage compartment to conform with ANSI C57.12.26 requirements with 200 Amp load break, externally clamped universal bushing wells.

B. Provide 2 Position (ON-OFF) load break, gang operated, oil immersed switch with external operating handle for operation with distribution hot stick.

C. Provide (2) 2-1/2 % full capacity taps above and below rated primary voltage with an external tap changer for de-energized operation.

D. Provide distribution class metal oxide surge arresters rated 9.0 KV which comply with the requirements on NEMA LA-1 in the transformer primary compartment for overvoltage protection of transformer and cables.

1. Provide surge arresters with 200 amp load break elbows, cabling, and mounting brackets suitable for installation in the primary compartment connected to one set of the loop feed primary bushing wells.

2.5 LOW VOLTAGE COMPARTMENT

A. Provide each transformer with side wall mounted secondary low voltage bushings including a full capacity neutral (grounded conductor) bushing with the following ratings:

1.	Insulation Class:	1.2 KV.
2.	BIL:	30 KV.
3.	One minute withstand:	10 KV.

B. Provide style H or J Spade secondary external terminations with four 9/16" holes on 1.75" centers arranged for vertical take-off of conductors.

1. Provide 4 hole mounted lugs suitable for connection of the secondary service conductors secured to the terminal spades with 1/2" bolts, hex head nuts and belleville washers.

2.6 INSULATION

A. Provide transformers with insulating fluid which is biodegradable and 100% edible seed oil-based

with food grade performance enhancing additives. Fluid shall have a minimum open cup fire point (ASTM D92) of 350^0 C and a minimum 5 day BOD (SM5210B) of 200 ppm. The fluid shall be FM Approved and UL Classified in accordance with NEC 450.23.

B. Provide NON-PCB classified insulating liquid with less than 0.5 parts per million (PPM) of PCB content. Provide each transformer with permanent NON-PCB label.

C. Provide insulating paper coated on both sides with thermosetting adhesive and properly cured prior to impregnating with oil or provide coils wound with conductors containing a thermosetting adhesive, properly cured to form an effective bond.

2.7 ACCESSORIES

A. Provide the following accessories with each transformer.

1. Nameplates to comply with ANSI standards C57 12.00 and C57 12.20 to include switch operating procedures, wiring diagram, gallons of insulating oil, manufacturer's name and address and all electrical ratings.

2. Filling plug and filter.

3. Dial type thermometer with resettable drag hand.

4. Liquid level gauge with resettable drag hand.

5. Drain valve with built-in sampling device.

6. Self actuating pressure relief device.

7. External anchorage brackets suitable for seismic zone 3.

PART 3 - EXECUTION

3.1 FACTORY TESTS

A. Prior to shipment of transformer, the manufacturer shall conduct standard factory tests in accordance with ANSI C57.12.90 and NEMA Standard TR-1 to include the following:

1. Ratio
2. Polarity
3. Phase Relation
4. Exciting Current
5. No Load Loss
6. Load Loss
7. Resistance Measurement
8. Impedance
9. Regulation (Calculated)
10. Applied Potential
11. Induced Potential

B. Submit certified test reports to the Owner and Engineer upon completion of the tests.

C. Notify the Owner and Engineer of any initial tests which do not meet the requirements of the above referenced test standards and of all corrective actions taken to overcome test failures.

Corrective actions to overcome test failures are subject to acceptance of the Owner.

3.2 INSTALLATION

A. Install transformers on concrete pads as detailed on the drawings. Carefully install units so as to not scratch finishes. After installation, inspect finished surfaces and touch up any scratches with a finish furnished by the transformer manufacturer prepared especially for this purpose.

B. Secure transformers to concrete pads with a minimum of four 5/8" x 6" anchor bolts.

3.3 FIELD TESTS

A. Upon completion of installation and prior to energization of the transformer, perform the following field tests:

1. Ratio Test at rated voltages and each tap setting to verify winding ratios.

2. Insulation resistance (Megger) tests at rated voltage for each voltage and tap setting to verify integrity of insulation and continuity of windings.

B. Submit copies of all test reports to the Owner and Engineer. Immediately notify the Engineer of any test failures.

* END OF SECTION 16320 *

SECTION 16340 - POLE LINE SWITCHGEAR AND APPARATUS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16300 - Primary Service and Distribution

C. Section 16400 - Secondary Service and Distribution

1.2 SCOPE

A. Provide new cutouts, fuses, surge arresters and other apparatus as shown on drawings, as specified herein and as required to provide protection of the electrical distribution system conductors and equipment.

PART 2 - PRODUCTS

2.1 FUSE CUTOUTS AND FUSES

A. Primary fuse cutouts shall be of non load break open type construction rated 15 KV and of the extra heavy duty type with 200 Ampere continuous current rating to provide a minimum symmetrical current interrupting rating of 10,600 Amperes. Open link cutouts are not acceptable.

B. Fuse ratings shall be as indicated on the drawings.

C. Furnish cutouts with mounting brackets suitable for the indicated installation and with hooks suitable for use with portable load break tools.

2.2 SURGE ARRESTERS

A. Furnish and install Surge Arresters for protection of aerial to underground transitions, group operated load interrupter switches, transformers and other indicated equipment.

B. Surge arresters shall be distribution-valve class rated 9 KV which comply with the requirements on NEMA LA-1 and shall be equipped with mounting brackets suitable for the indicated installations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment and apparatus in accordance with manufacturer's written instructions and recommendations and in accordance with standard practices.

B. Locate equipment and apparatus as required to provide minimum clearances and working space as required by the National Electrical Code and the National Electrical Safety Code.

* END OF SECTION 16340 *

SECTION 16370 - POLE LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide new crossarms, insulators, and mounting hardware on existing poles as required for installation of new fused cutouts, lightning arresters, and connection to underground conduit as shown on the drawings and as specified herein.

B. Provisions for communication services is required on existing pole line in accordance with the requirements of the National Electrical Safety Code, except where specifically noted otherwise.

PART 2 - PRODUCTS

2.1 CROSSARMS

A. Crossarms shall be 8 feet in length, except that longer crossarms shall be used where indicated or required, solid wood, distribution type conforming to the requirements of REA DT-5B:PE-16 with pressure treatment conforming to AWPA C25.

B. Crossarms shall be machined, chamfered, trimmed and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide for required climbing space and wire clearances.

C. Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

D. Support all crossarms with metal gains and metal angle crossarm braces. Crossarm braces shall not be less than 42 inch span.

E. Furnish double crossarms at ends of joint use or conflict sections, at dead ends and at angles and corners as indicated, to provide adequate vertical and longitudinal strength.

2.2 INSULATORS

A. Medium voltage line insulators shall have ratings not less than ANSI Class 55-6 for pin-type insulators and shall be radio interference freed.

B. Neutral conductors shall be insulated for crossarm mounting using insulators as required for line conductors. Neutral conductor insulators will not be required at dead ends.

2.3 HARDWARE

A. Pole line hardware shall be hot dip galvanized steel.

B. Suitable washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as

required. Washers used on through bolts and double arming bolts shall be approximately 2-1/4 inches square and 3/16 inches thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for under heads of carriage bolt shall be of the proper size to fit over square shanks of bolts.

C. Use eye bolts, bolt eyes, eyenuts, strain load plates, lag screws, guy clamps, fasteners, hoods, shims, and clevises wherever required to adequately support and protect poles, brackets, crossarms, guy wires and insulators.

PART 3 - EXECUTION

3.1 CROSSARM MOUNTING

A. Bolt crossarms to poles with 5/8 inch through bolts with square washers at each end. Bolts shall extend not less than 1/8 inch nor more than 2 inches beyond nuts.

B. On single crossarm construction, install the bolt head on the crossarm side of the pole.

C. Bolt angle braces to crossarms with 1/2 inch bolts with round or square washers between boltheads and crossarms and bolt crossarm to pole with 5/8 inch through bolts.

D. Secure double crossarms in position by means of 5/8 inch double arming bolts equipped with four nuts and four square washers per bolt.

E. Set equipment arms parallel or at right angles to lines as required to provide climbing space and locate below line construction to provide necessary wire and equipment clearances.

* END OF SECTION 16370 *

Camp W.G. Williams
Building 5080
DFCM #07332480

SECTION 16375 - MEDIUM VOLTAGE CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16110 - Raceways

C. Section 16120 - Low Voltage Conductors

1.2 SCOPE

A. Provide new copper conductors for the underground primary electrical distribution system as shown on the drawings and as specified herein.

1.3 STANDARDS

A. The following standards shall form a part of this specification to the extent specified herein:

1. AEIC CS-6 for Ethylene Propylene Rubber insulated shielded power cables.
2. ICEA Publication S-68-516, NEMA Publication WC8 for Ethylene Propylene Rubber insulated wire and cable.
3. UL Standard 1072 for Type MV-90 power cable.
4. ASTM B-8, B-231
5. IEEE 400-1980
6. Federal Register, Section 10CFR50, Appendix B
7. ANSI N45.2
8. IEEE 48-1990
9. IEEE/IPCEA Power Cable Ampacities, IEEE S-135

1.4 SUBMITTALS

A. Provide submittals for medium voltage cables, terminations and splices in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.

B. Include manufacturer's data on electrical cable and connectors for use at the specified voltage.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE CONDUCTORS

A. Low voltage conductors (600 volt and below) shall be as specified in Section 16120 -Conductors.

2.2 SINGLE CONDUCTOR MEDIUM VOLTAGE CABLE

A. Provide cable with Class B stranded annealed copper conductor per Part 2 of ICEA.

B. Cover the conductor with a layer of extruded conducting thermosetting compound, compatible with and firmly bonded to the cable insulation, in accordance with Paragraph D.1 and meeting

the requirements of Paragraph D.5 of AEIC CS6.

C. Apply a homogeneous wall of Ethylene Propylene Rubber insulation directly over the conducting extruded layer. The 133% insulation level thickness shall be 0.220 inches for 15 KV cable. The minimum thickness at any point shall be not less than 90% of the specified thickness. Physical and electrical properties of the insulation shall be in accordance with Paragraph 3.6 of ICEA.

D. Apply an extruded conducting thermosetting insulation shield over the insulation. It shall be in intimate contact with the outer surface of the insulation and shall be free-stripping, leaving no conducting particles or other residue on the insulation surface. This layer shall be legibly identified as being conducting. The average thickness of this layer shall be in accordance with Table C3 of AEIC CS6 for 15 KV cable. The insulation shield shall meet the resistivity requirements of Paragraph C.5 of AEIC CS6.

E. Helically apply a 5 mil annealed copper shielding tape with a minimum 20% overlap directly over the extruded insulation shield. This tape shall meet the requirements of Part 4 of ICEA.

F. Apply a Polyvinyl Chloride (PVC) jacket overall. The jacket shall meet the requirements of Part 4 of ICEA and the sunlight resistant requirements of UL Standard 1072. The jacket thickness shall be as specified in Part 4 of ICEA. The minimum thickness at any point shall be not less than 80% of the specified thickness.

G. Identify all cable by means of surface ink printing indicating manufacturer, size, insulation type insulation thickness, voltage rating, insulation level, year of manufacture and UL designations.

H. Cables shall be factory tested in accordance with AEIC CS6, ICEA S-68-516 and UL Standard 1072.

I. Acceptable manufacturers are Okonite, Pirelli, Rome, and Southwire.

2.3 SPLICES

A. All high voltage splices shall be made by qualified splicers and shall be made exactly as recommended by the cable manufacturer using standard splicing kits. The contractor shall not substitute materials or tapes without written approval of the cable and splice kit manufacturer. All insulation pencils or tapers shall be buffed smooth with recommended materials to eliminate all voids.

B. Splice kits may be of the heat-shrinkable type, of the premolded splice and connector type, the conventional taped type or the resin pressure filled overcast taped type.

C. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint.

D. Cable splices shall provide insulation and jacket equivalent to that of the cable.

E. Acceptable manufacturers are 3M and Raychem.

F. Cable splices will not be allowed except where specifically noted on the drawings and as approved in writing by the Engineer.

2.4 STRESS CONE TERMINATIONS

A. Where indicated on drawings, terminate medium voltage cables with heat shrink silicone rubber termination kits, porcelain termination kits or conventional taped termination kits which meet the requirements of IEEE 48, Class 1, suitable for indoor or outdoor locations.

B. Furnish termination kits suitable for the conductor size and insulation types encountered.

C. Furnish termination kits with grounding provisions for cable shielding.

D. Acceptable manufacturers are 3M and Raychem.

2.5 SEPARABLE CONNECTOR TERMINATIONS

A. Where indicated on the drawings, terminate medium voltage cables with insulated separable connectors which meet the requirements of ANSI/IEEE Standard 386.

B. Provide separable connectors with the following voltage ratings:

1.	Standard Voltage Class	15 KV
2.	Maximum rating Phase-to-Phase	14.4 KV
3.	Maximum Rating, Phase-to-Ground	8.3 KV
4.	AC 60 Hz 1 Minute Withstand	34 KV
5.	DC 15 Minute Withstand	53 KV
6.	BIL and full Wave Crest	95 KV
7.	Minimum Corona Voltage Level	11 KV

C. Provide 200 Ampere Load Break Elbows with the following current ratings:

1.	Continuous Current	200 Amperes
2.	Switching Current	10 Operations at 200 Amps RMS at 14.4 KV
3.	Fault Closure	10,000 Amps RMS symmetrical at 14.4 KV after 10 switching operations for 0.17 Seconds
4.	Short Time	10,000 Amps RMS symmetrical for 0.17 Seconds 3,500 Amps RMS symmetrical for 3.0 Seconds

D. Provide separable connectors which are dimensionally, mechanically and electrically interchangeable, whether used with parts of the same manufacturers or intermixed parts from several manufacturers.

E. Provide separable connectors complete with conductor contacts, housing, hot stick pulling eye, voltage test point, grounding eye and cable shield adaptor for grounding of the medium voltage cable shield.

F. Provide 200 Ampere inserts with ratings as specified above where required for connection to equipment supplied with universal bushing wells.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all single conductor medium voltage cable in raceways as specified in Section 16110 - Raceways.

B. Encase all underground medium voltage conduit in minimum of 3" of concrete.

C. Bury all underground medium voltage conduits minimum 36" below finish grade to top of concrete encasement.

D. Use galvanized rigid steel conduit, painted red for all exposed medium voltage conduit.

E. Lace medium voltage conductors together according to each three conductor circuit where passing through manhole or pullbox and separate only where necessary for connections to terminals, taps or cutouts.

F. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius.

3.2 IDENTIFICATION

A. Provide warning signs on all exposed medium voltage conduit and cable stating "DANGER - 12,470 VOLT" at points not more than 10 feet apart. Provide signs equal to Thomas & Betts type WDA, self-adhesive vinyl markers.

3.3 FACTORY TESTS

A. Factory tests shall be made on all high voltage cables consisting of AC and DC tests performed in accordance with ICEA S-68-516 and UL Standard 1072. Shield resistance to be measured and recorded from end to end on completed cable. Each reel of completed shielded power cable shall comply with maximum partial discharge in picocoulombs specified in AEIC CS-6.

B. Include certified factory test reports with delivery of cable. Forward copy of report to Engineer prior to installation of cable.

3.4 FIELD TESTS

A. Perform field tests on cables in accordance with NEMA WC8 and IEEE Standard 48 after installation of all cables, splices, and terminations but prior to connection to equipment. Isolate the cables as required prior to test by opening appropriate switches and disconnecting equipment.

B. Test the conductor for continuity.

C. Apply direct-current voltage on each phase conductor by connecting the conductor as one terminal and the grounds or metallic shielding as the other terminal. Use a DC tester specifically designed for the purpose, with overload current-limiting devices to limit short circuit current.

D. Start High potential DC test for the new cable and equipment at zero volts and increase in 5,000 volts increments until the recommended maximum voltage is reached.

1. Test voltage shall not exceed the recommendations of the above referenced standards unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing.

E. Maintain each voltage step value for a period of five minutes or until the leakage current is stabilized, whichever is less.

1. The leakage current shall be considered to be stabilized if the leakage current does not change more than five microamps in a 15 second period.

2. When leakage current does not stabilize, stop the test and re-test the cable. If the second test does not stabilize, discontinue the test.

F. Repair or replace any cable which fails testing due to a weakness of conductor insulation or defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections and perform a retest for acceptance.

G. Keep written record of the test results, recording leakage current at 30 Second intervals for the first 5 minutes of the test and at 1 minute intervals thereafter. Include all necessary test information such as cable system identification, ambient temperature, weather conditions, current, voltage, cable length, size, etc.

1. Forward written test report to Engineer and Owner within 48 Hours of test completion.

2. Include copies in the Operation and Maintenance Manuals.

* END OF SECTION 16375 *

SECTION 16390 - PRIMARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16450 - Secondary Grounding

1.2 SCOPE

A. Except where specifically noted otherwise, ground all non-current carrying metallic parts of electrical equipment, raceway systems and neutral conductor of the wiring system.

PART 2 - PRODUCTS

2.1 GROUND RODS

A. Furnish copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment.

2.2 GROUND CONDUCTORS

A. Use copper ground conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.

B. Use minimum No. 3/0 AWG conductors for distribution transformer grounding.

2.3 GROUND CONNECTIONS

A. Make all ground connections accessible for testing and inspection.

B. Make all aboveground ground connections with pressure type fitting in conformance with IEEE Standard 837

C. Make all underground ground connections by means of exothermic welding equal to Cadweld or Thermoweld in strict accordance with the manufacturer's written instructions.

2.4 EQUIPMENT GROUNDING

A. Equipment frames of metal-enclosed equipment, medium voltage cable shields at cable joints and terminations, metal splice boxes, and other noncurrent-carrying metal items shall be grounded unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Leave ground connections accessible for inspection.

B. Install all grounding in accordance with the latest edition of the National Electrical Code and the

National Electrical Safety Code.

3.2 GROUND RESISTANCE MEASUREMENTS

A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Owner and Engineer.

B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated number of ground rods, furnish and install additional ground rods, longer ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained, except that the total length of additional ground rods will not be required to exceed 50 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

* END OF SECTION 16390 *

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SECTION 16400 - SECONDARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16110 - Raceways

C. Section 16120 - Conductors

1.2 SCOPE

A. Provide complete electrical service as shown on drawings and as specified herein.

1.3 SUBMITTALS

A. Provide shop drawing submittals for Metering Equipment in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for Metering Equipment. Clearly indicate all options, accessories, finishes, etc., to be provided.

C. Include literature to verify compliance with referenced EUSERC, ANSI and UL Standards.

PART 2 - PRODUCTS

2.1 SYSTEM

A. The Secondary Electrical Distribution System will be 120/208 Volt, Three Phase, Four Wire, 60 Cycle for Lighting, Equipment, Appliances and Outlets.

2.2 SERVICE ENTRANCE

A. Provide new underground electrical service conduits and conductors as shown on the drawings from the main service transformer to the building service disconnect as indicated on the drawings.

2.3 METERING EQUIPMENT

A. Provide meter sockets to meet the requirements of ANSI C12.7, Requirements for Watthour Meter Sockets and 7UL/ANSI 414 Standard for Safety, Standard for Meter Sockets.

B. Provide a raintight combination meter/main breaker to include a manual EUSERC approved manual circuit-closing link bypass with safety socket facilities and sealing provisions as approved by the local power company.

2.4 METER

A. Provide a General Electric Type VM-65, 2 stator, 4 wire Y, 3 phase, Class 200, self-contained

Watthour meter with 120/208 Volt nameplate and Type M-90 Electronic 15 minute cumulative demand register for each new service.

1. Other acceptable meter manufacturers, subject to compliance with the contract documents are ABB and Sangamo.

B. Program each meter as required to display actual values without use of a multiplier.

2.5 FEEDERS

A. Sizes and connection of feeders are shown on the Power Riser Diagram. Feeders are sized to handle rated loads and to meet voltage drop conditions.

B. Do not install conductors of different sizes or types in the same conduits.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate electrical service and metering with Owner prior to beginning work.

B. Coordinate with Owner for proper voltage and recommended service transformer tap setting if required.

3.2 FEEDERS

A. Before or during final job site observation, check each panel feeder and main feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.3 POWER OUTAGES

A. Power outages to any portion of the existing building will not be allowed except on weekends, holidays and/or as directed by the Owner.

1. Submit written requests for power outages to the Owner not less than Seven (7) working days prior to all proposed outages.

2. Do not take any power outages without the Owners permission.

* END OF SECTION 16400 *

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SECTION 16440 - SAFETY SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16475 - Fuses

1.2 SCOPE

A. Provide all disconnect switches required by NEC or local regulations as shown on drawings and specified herein.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Safety Switch type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each switch type. Clearly indicate all options, accessories, finishes, etc., to be provided with each switch type.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Provide NEMA KS1, Heavy Duty Type HD, horsepower rated, quick-make, quick-break enclosed load interrupter knife switches, fusible or non-fusible as required, with externally operable handle, lockable in the OFF position and interlocked to prevent opening front cover with switch in ON position.

B. Maximum voltage, current rating and horsepower rating will be clearly indicated on a metal plate riveted or otherwise permanently fastened to the switch enclosure.

C. Provide switches with NEMA 1 enclosures or where indicated as weatherproof, NEMA 3R enclosures.

D. Provide fusible switches rated 600 amps or less with a UL listed rejection feature to reject all fuses except Class R fuses.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable safety switch manufacturers, subject to compliance with the contract documents, are Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each switch enclosure. Where

the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount safety switches 5'-0" above finished floor or grade to center of switch.

B. For exterior disconnects at condensing units or packaged rooftop units, mount top of switch at the same height as the top of the unit but not less than 24" above grade or roof to the bottom of the switch.

3.3 IDENTIFICATION

A. Provide an engraved nameplate for each switch in accordance with Section 16195 - Identification.

B. Provide adhesive tag on inside door of each fused switch indicating NEMA fuse class and rating installed.

* END OF SECTION 16440 *

SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Ground all non-current carrying metallic parts of electrical equipment, raceway systems and the neutral conductor of the wiring system as shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

A. Provide copper ground electrode conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.

B. Provide an insulated equipment ground conductor in all raceways on the load side of the service disconnect.

2.2 GROUND CONNECTIONS

A. Make the electrical service ground connection at the main service equipment and connect to metallic water service, and ground rods as shown on the drawings and in accordance with NEC Article 250, Part III.

B. Bond the neutral conductor to electrical service ground system at the main transformer and the main service equipment only.

C. Bond all interior metallic piping systems to the electrical service ground system.

D. Make above ground connections by means of pressure connectors, compression connectors, clamps or other means which are UL Listed and classified as suitable for purpose.

E. Make all underground connections by means of an exothermic welding process equal to Cadweld or Thermoweld, in strict accordance with manufacturer's written instructions and recommendations.

2.3 GROUND RODS

A. Provide copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment where indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Leave ground connections accessible for inspection.

B. Install ground rods minimum 8 feet into earth. Space adjacent ground rods minimum 6 feet apart.

C. Provide a separate ground terminal for each ground conductor in each panelboard, switchboard, and similar electrical equipment enclosures.

D. Install all grounding in accordance with the latest edition of the National Electrical Code.

3.2 GROUND RESISTANCE MEASUREMENTS

A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Owner and Engineer.

B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated ground electrodes, provide a supplementary ground electrode consisting of 3/4" x 10'-0" copper ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained. Total length of additional ground rods will not be required to exceed 30 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

* END OF SECTION 16450 *

SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide new panelboards complete with all necessary accessories as shown on drawings and as specified herein.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Panelboard in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include dimensioned construction drawings for each Panelboard. Clearly indicate voltage, ampacities, breaker types, conduit entrance areas, materials, options, accessories, finishes, etc., to be provided with each Panelboard. Include Series-Rated verification where required.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Provide dead front safety type panelboards, constructed in accordance with NEMA and UL standards, with plated aluminum or copper bus bars.

B. Provide each panelboard with main circuit breaker, single lugs or double lugs for attaching feeder conductors and/or sub-feeder conductors as shown on the drawings.

C. All panelboards to be 20" wide minimum.

D. Provide panelboards with NEMA 1 enclosures unless indicated otherwise on the drawings.

E. Arrange circuit breakers in double vertical row configuration with bolted bus connections.

F. Provide lighting and appliance panelboard fronts with concealed steel door hinges and a flush mounted combination latch and lock. Cover shall be full length hinged (door-in-door construction) Key all locks alike for all panelboards furnished for the project.

G. Provide each panelboard with an approved circuit index holder with transparent protective cover on the inside of panelboard door.

H. Provide a ground bus in each panelboard with a separate terminal for connection of each feeder and each branch circuit ground conductor.

I. Panelboard schedules as shown on drawings.

2.2 CIRCUIT BREAKERS

A. Provide thermal-magnetic type circuit breakers unless noted otherwise.

B. Provide multi-pole breakers with trip elements in each pole and common trip handle.

C. Provide "HACR" rated circuit breakers to serve heating, ventilating and air conditioning equipment branch circuits.

D. Provide "SWD" rated circuit breakers to serve all lighting and outlet branch circuits.

E. Plug-in breakers are not acceptable for use in panelboards.

2.3 INTERRUPTING RATING

A. Provide panelboards with minimum short circuit current interrupting ratings as shown on the drawings.

B. The interrupting rating of circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified for the panelboards.

C. The minimum interrupting ratings of circuit breakers used as feeders and branches may be in accordance with UL 489 tested and certified series-connected circuit breaker combinations. All electrical equipment using the Series Rated circuit breaker combinations shall be clearly marked on the panel nameplate and feeder breaker indicating the same.

2.4 ACCEPTABLE MANUFACTURERS

A. Acceptable panelboard manufacturers, subject to compliance with the contract documents, are Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each panelboard. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount panelboards 6 feet above finished floor or grade to top of panel.

B. Where panelboard exceeds 6 feet in height, arrange the panelboard so that the top operating handle does not exceed 6'-6" above finished floor or grade.

3.3 IDENTIFICATION

A. Provide nameplates and neatly typed circuit index for each panelboard in accordance with Section 16195 - Electrical Identification.

* END OF SECTION 16470 *

SECTION 16475 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide fuses of the proper sizes and rating for each fusible switch as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 FUSES

A. Provide UL Class L or UL Class R, current limiting fuses, rated for up to 200,000 amperes interrupting capacity.

1. For branch circuits feeding motors, furnish UL Class RK5, Time-Delay fuses and for branch circuits other than motors, furnish UL Class RK5 non time delay fuses.

B. Provide fuses which are a standard product of Bussman, Cefco, Gould/Shawmut, or Reliance.

2.2 SPARE FUSES

A. Provide a 20 percent complement, but not less than three, of each rating of each type of fuse used on the project. Turn over spare fuses to the Owner during or prior to Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install only fuses of the same type and rating in each fusible switch.

3.2 COORDINATION

A. Coordinate fuse sizes for packaged mechanical equipment with mechanical contractor. Provide fuse sizes as indicated on the equipment nameplate.

* END OF SECTION 16475 *

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SECTION 16480 - MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide motor starters, pushbutton stations, and other necessary operating devices for all Motors and Equipment as shown on the drawings and as specified herein.

B. Thermostats and similar control devices and control wiring for control of heating, ventilating and air conditioning equipment will be furnished and installed by the Controls Contractor under the provisions of Division 15 Specifications.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Motor Starter in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each starter type. Clearly indicate all sizes, ratings, control devices, options, accessories, finishes, etc., to be provided with each starter.

C. Include typical control wiring diagram for starters provided with accessories such as start-stop pushbuttons, control transformers, pilot lights, etc.. Number terminals and wiring on submittal drawings to match numbering on actual devices.

PART 2 - PRODUCTS

2.1 MOTORS

A. Unless otherwise noted herein or on the drawings, motors will be furnished under Division 15 Specification Sections.

B. In general, motors 1/2 HP and smaller will be Single-Phase rated at 115 or 120 volt. Motors and equipment larger than 1/2 HP will be Three-Phase with nameplate rating of 200 or 208 volt when used on a 120/208 volt system.

2.2 MOTOR STARTERS

A. Provide NEMA rated motor starters and control devices.

B. Do not use IEC rated motor starters and control devices.

2.3 MANUAL MOTOR STARTERS

A. Provide Square D Class 2510 type F, or equal, single phase manual motor starting switches with overload heaters for each single phase motor where indicated on drawings.

B. Provide manual motor starting switches with pilot light where indicated on drawings.

2.4 MAGNETIC MOTOR STARTERS

A. Provide Square D Class 8539 combination magnetic motor starters with adjustable instantaneous trip circuit breaker disconnect of appropriate size and style for each three phase motor where indicated on drawings.

B. Provide overload relay with three heaters for each starter, sized to accommodate overload heaters rated at 130% of the full load current of the motor which the starter controls. Install overload heaters rated approximately 115% of the motor full load current.

C. Provide each starter with HAND-OFF-AUTO selector switch coordinated with the automatic temperature control system.

D. Provide each starter with a Red pilot light to indicate motor operation.

E. Provide each starter with an individual fused control transformer connected such that removal of power to the starter will remove all control voltage from the control circuit.

1. Provide the starter disconnecting means with an electrical interlock or auxiliary contact where required to disconnect interlocking control circuits. Coordinate control and interlocks with the Controls Contractor to maintain this requirement.

F. Provide each starter disconnecting means for padlocking in the OFF position.

2.5 ENCLOSURES

A. Provide starters with NEMA 1 Enclosures where located in indoor normally dry locations.

B. Provide starters with NEMA 12 Enclosures where located in humid, corrosive and oily locations such as Boiler Rooms, etc..

C. Provide starters with NEMA 4X enclosures where located in outside or in wet locations. Provide suitable drain for starters located outside in accordance with the manufacturers written instructions.

2.6 HEATER CHARTS

A. Provide manufacturer's standard chart inside the door of each starter indicating overload heater types, sizes and ratings for the starter.

2.7 ACCEPTABLE MANUFACTURERS

A. Acceptable motor starter manufacturers, subject to compliance with the contract documents, are Allen Bradley, Cutler Hammer, Furnas, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on

center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount individual motor starters 4'-0" above finished floor or grade to center of starter.

3.3 COORDINATION

A. Give special attention to wiring and controls for two-speed motors or motors with special controls at no additional cost to the Owner.

B. Determine exact location of all electrical devices controlling mechanical equipment in cooperation with the Mechanical Contractor in the field before roughing-in.

* END OF SECTION 16480 *

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SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all lighting fixtures, as shown on drawings and as described herein, complete with all necessary wiring, sockets, lamps, auxiliaries, supports, etc..

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Fixture and Ballast type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each fixture type. Clearly indicate all options, accessories, finishes, etc., to be provided with each fixture type.

C. Include Manufacturer's standard published literature for each ballast type to be used on the project. Provide literature for each ballast manufacturer which the fixture manufacturer may use depending upon availability at the time the fixtures are manufactured.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Provide fixtures which comply with the appropriate Underwriters Laboratories (UL) Standards for the fixture type and which are UL Listed and UL Labeled.

B. Acceptable fixture manufacturers and types are indicated on the Fixture Schedule included with the Drawings.

1. Listing of the manufacturer's catalog numbers on the Fixture Schedule is intended to establish the general fixture type required and does not relieve the contractor and/or supplier from the responsibility to provide all accessories and options included in the fixture description nor from meeting the requirements of this specification.

C. Provide all recessed light fixtures with thermal protection in compliance with NEC Article 410-65 (c) and UL Test Standard 1571.

D. Provide individual fixtures with multiple ballasts as required to meet lamp switching requirements shown on the drawings.

2.2 FLUORESCENT BALLASTS

A. Provide UL Listed, CBM-Certified by ETL, Premium Class ‘P”, Solid State Electronic, fluorescent ballasts with Class 'A' sound rating which meet the energy efficient requirements of Public Law 100-357 (National Appliance Energy Conservation Amendment of 1988 to the Energy Policy and

Conservation Act of 1987) for the lamp types to be served by the ballast.

B. Electronic Ballasts shall operate lamps at a frequency of 20 to 35 KHz with no detectable lamp flicker, shall comply with FCC and NEMA limits governing EMI and RFI, and shall not interfere with the operation of other normal electric and electronic equipment.

C. Ballasts shall be potted, in a steel case and contain no PCBs. Operating temperature of the ballasts shall not exceed 60^0 C at any point on the case during normal operation.

D. Provide fluorescent ballasts with the proper lamp circuit voltage and rating for the lamp types to be served by the ballast and with the following operating characteristics:

1.	Minimum Ballast Factor	0.88
2.	Minimum Power Factor	95%
3.	Maximum Total Harmonic Distortion (THD)	10%

E. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing, CBM Certification and Date of Manufacture Code.

F. Electronic Ballast Warranty shall be 5 Years from the "Date of Manufacture" Code on the ballast.

G. Fluorescent Ballasts shall be of U.S. Manufacture. Acceptable Manufacturers, subject to compliance with Contract Documents, are Advance, Magnetek and Sylvania.

2.3 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Provide UL Listed, High Power Factor, High Intensity Discharge (HID) Ballasts which conform to the applicable ANSI Designation for the wattage and type of lamp served.

B. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing and Date of Manufacture Code.

C. HID Ballasts shall contain no PCB's.

D. HID Ballast Warranty shall be 2 Years from the "Date of Manufacture" Code on the ballast.

2.4 LAMPS

A. Provide lamps of the Wattages, Types, and with color characteristics as indicated on the Fixture Schedule included with the Drawings.

B. Provide incandescent lamps rated for 120 volt unless otherwise specified.

C. Provide fluorescent lamps which conform to the Energy Policy Act of 1992 and the applicable ANSI Designations for the lamp wattage and type.

1. Fluorescent Lamps shall be compatible with supplied ballasts to meet the energy conservation requirements of Public Law 100-357.

D. Provide new fluorescent lamps with reduced mercury content, such as Phillips "Alto" Series Fluorescent Lamps, to meet the requirements of the EPA Resource Conservation Recovery Act for Toxic Characteristic Leaching Procedure.

1. Reduced mercury content lamps will not be required for lamp types which are not available from any of the acceptable lamp manufacturers with reduced mercury content.

E. Provide High Intensity Discharge (HID) lamps suitable for the installed burning position which conform to the applicable ANSI designations for the wattage and type of lamps specified on the drawings.

F. Acceptable Lamp Manufacturers, subject to compliance with the Contract Documents are General Electric, Phillips, Sylvania and Venture.

2.5 EMERGENCY FLUORESCENT BATTERY PACKS

A. Provide emergency battery pack in fluorescent fixtures where indicated on drawings. Connect battery packs to the same branch circuit as the fixture, ahead of any local switches.

B. The emergency battery packs shall consist of a high temperature nickel cadmium battery, battery charger and electronic circuitry contained in a single case furnished with charging indicator light and test switch for field installation in the fixture housing.

C. The emergency battery pack shall be capable of operating with either a magnetic or electronic fluorescent ballast, produce between 1,100 and 1,200 initial lumens from a single lamp and provide a minimum of 90 minutes of emergency illumination.

D. The emergency battery pack shall have UL Component Recognition and be UL listed.

E. The emergency battery pack shall be fully guaranteed for five years.

F. Acceptable Manufacturers, subject to compliance with the Contract Documents:

1. Bodine B50
2. Iota I-80
3. Lithonia PS1100
4. Mule MF40-50

2.6 EXTRA STOCK

A. Provide the following extra stock of materials to the Owner.

1. Lamps: 10% , but not less than 1 of each type used on the project.

2. Fixtures lenses and louvers: 10%, but not less than 1 of each type used on the project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Properly center fixtures in each room. Where multiple fixtures occur, space them uniformly and in straight lines with each other.

B. Locate recessed ceiling light fixtures to center on a single tile or at the intersection of four tiles.

C. Carefully lay out all openings required for recessed lighting units. Cooperate with other contractors and make provisions for openings of exact dimensions required and provide all required plaster rings and ground frames to be inserted in openings.

D. Where lighting fixtures are shown to conflict with locations of structural members and mechanical or other equipment, provide adequate supports and wiring to clear same.

3.2 SUPPORTS

A. Provide all necessary connectors, straps, etc., for secure mounting of all fixtures.

B. Secure fixtures in suspended grid type ceilings to the grid members using a device capable of holding 100% of the fixture weight acting in any direction. Provide 12 gauge galvanized steel ceiling support wires attached to grid members within 3" of each corner of the fixture. Tandem fixtures may utilize common grid member support wires.

1. Fixtures weighing less than 56 pounds in suspended grid type ceilings shall also be secured to building structure independent of the ceiling support system with a 12 gauge galvanized steel wire or #10 jack chain located at diagonally opposite corners of the fixture. These wires or chains may be slack.

a. Provide recessed can type fixtures with metal bar hangers attached to the ceiling grid system. Secure fixtures to the building structure as specified above.

b. Support surface mounted fluorescent fixtures installed on suspended grid type ceilings from the building structure by means of independent support clips equal to Caddy No. IDS with proper stud length for fixture installed, and minimum of two 12 gauge galvanized steel support wires.

2. Fixture weighing 56 pounds or more in suspended grid type ceilings shall be supported directly from the structure above by approved hangers.

C. Support recessed fixtures installed in gypsum board ceilings to the ceiling support system with metal bar hangers or suitable brackets.

D. Support surface mounted fluorescent fixtures installed on gypsum board or concrete ceilings from the ceiling with proper anchors at each corner of the fixture.

E. Fixtures designed to be supported from the outlet box will not require any additional support. Provide proper outlet box with fixture stud or plaster ring suitable to support the fixture. Secure the outlet box to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater.

3.3 LAMP BURN-IN

A. Burn-in all fluorescent and HID lamps for a minimum of 100 hours prior to completion of the project and replace all defective lamps.

3.4 COORDINATION

A. Coordinate ceiling types with General Contractor and verify compatibility with fixture mounting provisions prior to ordering fixtures. Immediately notify the Architect in writing of any discrepancies between ceiling types and specified fixture types.

B. Verify available voltages and coordinate fixture voltage with the fixture supplier prior to ordering fixtures. Immediately notify the Architect in writing of any discrepancies between available voltages and the specified fixture voltages.

C. Coordinate fixture locations with other contractors to provide adequate clearance between fixtures and ductwork, piping, structural members, etc., for proper installation of fixtures and provide access for maintenance or replacement of the fixtures.

* END OF SECTION 16500 *

SECTION 16720 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:

1. Section 16110: “Raceways”
2. Section 16140: “Electrical Boxes”

1.2 SCOPE

A. Provide microprocessor controlled, intelligent reporting fire alarm equipment as required to form a complete, operative, coordinated system to include, but not be limited to, fire alarm control panel, alarm initiating devices, alarm notification appliances, fire safety function control devices, annunciators and wiring as specified herein.

1. Provide the system with minimum 15% spare capacity.

B. The fire alarm system shall transmit separate and different alarm, supervisory and trouble signals via a digital alarm communication transmitter by telephone to the existing guard station located at the main entrance to Camp Williams.

1.3 STANDARDS

A. The applicable provisions of the following industry standards are considered minimum requirements for fire alarm system work and are made a part of the contract documents:

1. National Electrical Code, NFPA 70-2008
2. National Fire Alarm Code, NFPA 72-2007
3. International Fire Code
4. International Building Code
5. International Mechanical Code
6. Rules, regulations and/or ordinances of local Authority Having Jurisdiction (AHJ) who is the Utah State Fire Marshal.

B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Architect promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Architect.

1.4 QUALIFICATIONS OF PERSONNEL

A. Supervision of the fire alarm system installation, final connections, programming, and testing will be provided by personnel who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel include, but are not limited to, the following:

1. Fire alarm system manufacturer’s factory trained and certified personnel.

2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
3. Personnel licensed or certified by state or local authority.

1.5 SUBMITTALS

A. Provide submittals for the Fire Alarm System in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.

B. Provide complete submittals in accordance with the International Fire Code, Section 907.1.1 to include, but not be limited to, the following:

1. Building floor plan drawings showing location of the main fire alarm control panel, auxiliary control panels, initiating devices, notification appliances, control relays, pullboxes, wiring, etc., and connections to the fire alarm system.

a. The fire alarm system drawings included with the contract documents will be made available to fire alarm system supplier in electronic format, Autocad or DXF, as requested.

2. Battery calculations to verify specified back up period.

3. Voltage drop calculations to verify all devices will operate within the device voltage limits.

4. Typical wiring diagrams for signaling line circuits, initiating device circuits, notification appliance circuits and fire safety function control circuits.

5. Provide manufacturer's standard catalog literature for all Fire Alarm System Equipment and Devices. Indicate specific item and options to be furnished where more than one item or option is included in the catalog literature.

C. Submit qualifications and certifications of personnel who will be responsible for supervision of installation, system programming, final connections, and testing.

D. In addition to routine submission of the above material, make an identical submission to the local Authority Having Jurisdiction for review. Upon receipt of comments from the Authority, resubmit if required to make clarifications or revisions to obtain approval.

1. Approval of the AHJ is required prior to installing any part of the Fire Alarm System.

1.6 RECORD DRAWINGS

A. Update fire alarm system submittal drawings upon completion of the installation for use as Record Drawings of the fire alarm system equipment and wiring as installed.

1. Include building floor plan drawings showing location of all initiating devices with address number, notification appliances, junction boxes, pull boxes, etc., and approximate routing of cables, conduits and connections to each device including wire numbers.

2. Provide schematic wiring diagram of the system to include, but not be limited to, initiating device circuit wiring, notification appliance circuit wiring, fire safety function control circuit wiring and remote station transmitter wiring. All wiring and terminals shall be numbered to match numbering of installed wiring and terminals.

B. Provide one set of full size Record Drawings on reproducible media.

C. Provide all record drawings in electronic format, AutoCad, DXF, or other format acceptable to the Owner.

D. Provide blue or black line prints of the record drawings in the Operation and Maintenance manuals along with required maintenance material. Leave one set of prints inside the main control panel or suitably protected and available in the vicinity of the main control panel.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Provide complete operation and maintenance manuals listing the manufacturer's name(s) and service organizations complete with addresses, telephone numbers and other pertinent information.

B. Provide technical data sheets for the control panel and each device including all features and operating sequences, both automatic and manual. Indicate specific model(s) provide where more than one model is included on the data sheets. Indicate all options and accessories provided for each item.

C. Provide wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment.

D. Provide a clear and concise operating instructions that give, in detail, the information required to properly operate the equipment and system.

E. Provide copies of all system tests.

1.8 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Keys for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 keys.

2. Replaceable Plug-in LED's: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

3. Notification Appliances: Furnish quantity equal to 10 percent of the number of units installed, but not less than one of each type.

4. Automatic Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.

5. Detector Bases: Furnish quantity equal to 5 percent of the number of units of each type installed but not less than one of each type.

B. Turn over extra materials to the Owner during or prior to Final Testing. Obtain written receipt for the materials and include copy in the operation and maintenance manuals.

1.9 WARRANTY AND MAINTENANCE SERVICE CONTRACT

A. Provide a 1 Year Warranty for the fire alarm system in accordance with the General Conditions and Division 1 Specifications.

B. Provide a 12 Month Maintenance Service Contract for the new fire alarm systems and equipment, using factory-authorized service representatives.

1. Basic Services: Systematic, routine maintenance visits at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

2. Occupancy Adjustments: When requested during the maintenance service contract period, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3. Inspection and Testing: Provide complete system inspection and testing of the system in accordance with NFPA 72, paragraph 10.4.3 including annual testing at the end of the 12 month maintenance service contract period.

C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept the maintenance service contract renewal proposal.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Acceptable fire alarm system manufacturers, subject to compliance with the contract documents, are:

1. Fire Control Instruments (FCI)
2. Notifier
3. SimplexGrinnell
4. Radionics

2.2 UL LISTING

A. All items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by the Underwriters Laboratories, Inc. (UL), shall bear the "UL" label and shall display the manufacturer's name on each component. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing is not acceptable.

B. All control equipment must have transient protection devices to comply with UL864 requirements.

C. In addition to the UL UOJZ requirements listed above, the system controls shall be UL listed for

Power Limited Applications per NEC 760. Mark all system control circuits in accordance with NEC Article 760-42.

2.3 BASIC SYSTEM REQUIREMENTS

A. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Class A Style 6 Signaling Line Circuits (SLC).

B. Conventional Initiating Device Circuits will be allowed only to monitor conventional devices such as hood fire suppression systems via an addressable monitor module. Provide a separate addressable monitor module for each device to be monitored unless specifically noted otherwise on the approved fire alarm system drawings.

1. Initiating Device Circuits (IDC) shall be wired NFPA Class A, Style D, except that Class 'B', Style 'B' IDC may be used to monitor a single device with the monitor module located within 3 feet of the device.

C. Notification Appliance Circuits (NAC) shall be wired NFPA Class A, Style Z.

D. Power for initiating devices must be from the main fire alarm control panel. Power for notification appliances may be from the main fire alarm control panel or a notification appliance circuit panel supervised by the main fire alarm control panel.

E. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

F. Pre-signal and alarm verification type system functions will not be allowed except as approved writing by the Authority Having Jurisdiction.

2.4 FIRE ALARM CONTROL PANEL (FACP)

A. The FACP shall contain a microprocessor-based central processing unit (CPU) to communicate with and control devices and equipment used with the system including, but not limited to, addressable detectors, addressable modules, local operator terminals, and other system controlled devices.

1. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.

2. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm and trouble logs shall be provided. Logs shall be accessible through the control panel annunciation panel or by connection to a remote printer.

B. The FACP shall perform the following functions:

1. Supervise and monitor all addressable detectors, monitor modules and control modules connected to the system for normal, trouble and alarm conditions.

2. Supervise all initiating device, signaling line, and notification appliance circuits throughout the facility.

3. Detect the activation of any initiating device and the location of the alarm condition.

4. Operate all notification appliances and fire safety functions as programmed.

5. Visually and audibly indicate trouble, supervisory, or alarm conditions.

C. Provide the FACP with a full featured operator interface control and annunciation panel consisting of a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alpha-numeric keypad for field programming and control of the system.

1. The LCD shall indicate system status under normal conditions. Under alarm conditions, the LCD shall display address number and the specific location of the initiating device in alarm. Under other abnormal conditions, the LCD shall display the type of condition and device or circuit which is not in a normal operating state.

2. The control panel shall include separate LED indicators for “AC Power On”, “Alarm”, “Trouble”, “Supervisory”, and “Silence”.

3. The control panel shall include separate switches for “Alarm Acknowledge”, “Alarm Silence”, “System Reset”, and “Drill”. The switches shall be accessible only by entering a locked control cabinet. The lock shall be keyed the same all other system keys.

D. The FACP CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any module shall be detected and reported to the system annunciation panel by the CPU.

2.5 POWER SUPPLY

A. Connect the FACP to 120 VAC power via a dedicated circuit. The FACP shall include necessary power supplies to provide 24 VDC power for the control system and equipment.

1. Provide a lock-on device for the circuit breaker serving the fire alarm system and paint the circuit breaker red in color.

2. All circuits requiring system operation power shall be 24 VDC and shall be individually fused at the control panel.

B. Provide each system with maintenance free, gelled electrolyte, batteries with sufficient capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon normal power failure. All battery charging and recharging operations shall be automatic and supervised.

2.6 DIGITAL ALARM COMMUNICATION TRANSMITTER

A. Provide a Digital Alarm Communication Transmitter (DACT) meeting the requirements of NFPA 72 for connection via dedicated telephone lines to the security guard station located at the main entrance to Camp Williams.

1. Coordinate transmission protocols and requirements with the Utah National Guard prior to purchasing the DACT.

B. The DACT shall be capable of transmitting separate and distinct alarm, trouble, and supervisory signals.

2.7 INITIATING DEVICES

A. All initiating devices shall be addressable and connected to the FACP signaling line circuit with two wires and receive necessary operating power from the signaling line circuit.

2.8 ADDRESSABLE DETECTORS

A. Smoke detectors and thermal detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base or the detectors. Install each detectors on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. Removal of any detector head from the base shall cause a trouble signal to be sounded at the main fire alarm control panel.

B. Provide smoke and thermal detectors with alarm and power/polling LED which shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED shall be placed into steady illumination when an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program.

C. Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device, i.e. ionization, photoelectric or thermal detector.

D. Photoelectric detectors shall be addressable devices and shall use the light-scattering principal to measure smoke density.

E. Thermal detectors shall be addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute.

2.9 ADDRESSABLE MANUAL PULL STATIONS

A. Provide dual action, non-breakglass type, manual pull stations with clearly visible operating instructions on the cover. The word FIRE shall appear on the front of the stations in raised letters.

B. Provide each pull station with a key operated test-reset lock designed so that after actual emergency operation, use of a key is required to restore the pull station to normal use, and to allow use of the key lock to test the pull station without operating the handle. Pull stations shall use the same key as the main fire alarm control panel.

C. All operated stations shall have a positive, visual indication of operation.

D. Provide addressable pull stations with an addressable communication module for connection to a signaling line circuit. The module shall, on command from the control panel, send data to the panel representing the state of the manual switch and the communication module status.

2.10 ADDRESSABLE MONITOR MODULE

A. Provide addressable monitor modules to connect one supervised initiating device circuit of conventional alarm initiating devices (any normally open dry contact device such as hood fire suppression system switches, supervisory switches, etc.,) to a signaling line circuit.

B. The monitor module shall provide Class A, Style D or Class B, Style B initiating device circuits. Style B circuits may be used to monitor single devices located within 3 feet of the monitor module. Use Style D circuits to monitor multiple devices and where devices are located more than 3 feet from the monitor module.

C. Provide monitor modules with an off-white impact resistant thermoplastic or lexan cover suitable for mounting in a standard 4-inch square x 2-1/8 inch deep electrical box.

D. Provide monitor modules with a LED that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The LED shall be placed into steady illumination when an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program.

2.11 ADDRESSABLE CONTROL MODULE

A. Provide addressable control modules where required to supervise and control the operation of the protected premises fire safety functions as indicated on the drawings. Control modules shall receive operating power from a signaling line circuit.

B. Provide control modules capable of being set to operate as a single pole, double throw dry contact relay with the following minimum ratings:

1. 2.0 amps at 30 VDC, resistive (1.0 power factor)
2. 0.6 amps at 30 VDC, inductive (0.60 power factor)
3. 0.3 amps at 120 VAC, pilot duty (0.35 power factor)

C. Provide control modules with an off-white impact resistant thermoplastic or lexan cover suitable for mounting in a standard 4-inch square x 2-1/8 inch deep electrical box.

D. Provide control modules with a LED that shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. If required, the LED flash shall have the ability to be removed from the system program.

2.12 FIRE SAFETY FUNCTION CONTROL RELAYS

A. Provide relays where required to control the protected premises fire safety functions such as fan shut down, door release, etc., as indicated on the drawings.

B. Provide control relays with single pole double throw contacts rated minimum 10 amps at 120 VAC resistive. Provide relays with higher rated contacts where indicated on the drawings or required by the controlled equipment.

C. Provide relays with multi-voltage coil suitable for operation at 24 VDC, 24 VAC, 120 VAC or 240 VAC. Connect the relay coil to a normally closed auxiliary contact in the fire alarm control panel or through an addressable control relay such that the relay will be normally energized and loss of power will cause the fire safety function to occur.

D. Provide control relays in a separate enclosure within 3 feet of the controlled equipment, or inside the equipment control panel as indicated on the drawings.

E. Connect the controlled equipment control circuit to the control relay output contacts so that the required fire safety function (fan shut down, door release, etc.,) will occur upon general fire alarm or upon loss of power. Connect the equipment control circuit ahead of any local control switches such that the fire safety function will occur regardless of the equipment control settings.

2.13 ALARM NOTIFICATION APPLIANCES

A. Provide Notification Appliances to meet the requirements of NFPA 72, UL 1971, ANSI S3.41 and ANSI 117.1. Provide combination devices where indicated on the drawings.

B. Provide horns to produce minimum 86 dB at 10 feet and to produce a temporal code pattern in accordance with ANSI S3.41.

C. Provide Xenon strobe lights with lexan lens with the word “FIRE” in red letters, meeting ADA, UL 1971 and NFPA-72 requirements, and with minimum effective candlepower ratings for coverage areas indicated on the drawings. Strobes shall be synchronized where two or more are located in the same area or room.

D. Provide suitable backboxes as recommended by the manufacturer for each notification appliance. Appliances will be semi-flush mounted to a flush mounted outlet boxes except where surface mounted appliances are specifically indicated on the drawings or approved by the Architect.

2.14 WIRING

A. Install all fire alarm system wiring approved raceway systems as specified for power wiring except that minimum 1/2" trade diameter raceways may be used for remote control, signaling and power-limited circuits which meet the requirements of National Electrical Code Article 725.

B. Provide size and type of wiring as required by the fire alarm system manufacturer. In general provide solid conductors except where stranded conductors are specifically required by the fire alarm system manufacturer.

2.15 SYSTEM OPERATION

A. Actuation of any manual station, smoke detector, heat detector or fire suppression system shall cause the following operations to occur unless otherwise specified:

1. Transmit alarm signal to the existing guard station located at the main entrance to Camp Williams.

2. Activate all programmed horns, until silenced at the main control panel.

3. Activate all strobe units until the main control panel is reset.

4. Shut down all air handling fans.

B. Activation of any Fire Suppression System or Fire Sprinkler System supervisory switch, shall cause a system supervisory alarm indication.

C. Alarm signals may be reset or silenced only by authorized personnel by entering a locked control cabinet and operating the proper silencing switch.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install the fire alarm system in strict accordance with the applicable sections of the National Fire

Alarm Code, National Electrical Code, other applicable NFPA Standards, Regulation of the Local Authority Having Jurisdiction (AHJ), the Contract Documents and the Manufacturer's written instructions and recommendations.

1. The fire alarm system drawings included with the contract documents are intended only to indicate minimum system requirements. Install the fire alarm system according to submittal drawings which have been reviewed and approved by the Authority Having Jurisdiction.

B. Install all wiring in strict compliance with all the provisions of NEC Article 760 A and C, for Power-Limited Fire Alarm Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC Article 760 A and B. Upon completion, the contractor shall so certify compliance in writing to the owner.

C. Clean all spatters, spots, dirt and debris from the inside and the outside of all fire alarm equipment and devices upon completion of the installation using methods and materials recommended by the fire alarm system manufacturer.

3.2 WIRING INSTALLATION

A. Install all cables or raceways concealed within ceilings or walls. Exposed cables or raceways will not be permitted unless specifically shown on the drawings or approved in writing by the Architect.

B. Support raceways, outlet boxes, etc., in accordance with the appropriate Division 16 Specification Section.

C. Color code fire alarm system wiring as recommended by the manufacturer. Identify individual conductors in each outlet box, pull box or other accessible location according to the circuit type with self adhesive printed markers equal to Thomas & Betts "E-Z Code" markers.

D. Paint all fire alarm system junction boxes, pull boxes, etc. red with identification of circuits served indicated on the device or box.

E. Do not install fire alarm system wiring in raceways or enclosures with any other wiring systems.

3.3 IDENTIFICATION

A. Identify all control panel switches, indicator lights, etc., by means of engraved laminated plastic nameplates or other permanent means acceptable the Owner and AHJ.

B. Identify each initiating device with address number by means of 25 point Kroy labels.

C. Provide a building map at the fire alarm control panel to show building floor plan with location of all initiating devices and address number of each device.

1. Orientation of the building map shall match the building orientation when viewed from the control panel, i.e., devices on the left of the map will be to the left of the control panel.

2. Install the building maps behind a tamper resistant tempered glass or Lexan cover not obscuring any control or indicating device.

D. Hand written labels and nameplates of any kind are not acceptable.

3.4 TESTS

A. Conduct a complete operational tests of the completed fire alarm system in accordance with NFPA-72 in the presence of the Owner, the Architect and/or Engineer and the AHJ to demonstrate that the system functions properly in every respect.

B. Testing and adjustment of the system shall be performed by the qualified person(s) who have supervised the installation of the system as required in paragraph “Qualification of Personnel”.

C. Determine through pretesting, conformance of the system to the requirements of the contract documents and the approved submittal installation drawings.

1. Correct deficiencies observed in pretesting.

2. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

3. Adjust horn taps where available to provide acceptable sound levels in all areas of the building.

D. Final Test Notice: Provide a minimum 10-day notice in writing when the system is ready for final acceptance testing. Schedule the final test at a time acceptable to the Owner, the Architect and/or Engineer, and the Authority Having Jurisdiction.

1. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

2. Put the complete Fire Alarm System on battery power not less than 24 hours prior to time of testing. Initiate an alarm and operate all Notification Appliances for not less than 5 minutes on battery power prior to restoring normal power.

3. Verify receipt of alarm, trouble and supervisory signals at the Camp Williams guard station.

4. Close each fire suppression system valve and verify proper supervisory alarm at the FACP.

5. Verify activation of all fire suppression system flow switches.

6. Open and short each initiating device circuit and verify that the trouble signal actuates.

7. Open and short signaling line circuits and verify that the trouble signal actuates.

8. Open and short Notification Appliance Circuits and verify that trouble signal actuates.

9. Ground all circuits and verify response of trouble signals.

10. Check presence and audibility of all audible notification appliances throughout the protected premises.

11. Check presence, visibility and synchronization of all visible alarm notification appliances.

12. Check installation, supervision, and operation of all automatic detectors.

13. Introduce each of the alarm conditions that the system is required to detect onto the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

14. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

E. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system complies with applicable standards and the contract documents.

F. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Include copy of test reports in the Operation and Maintenance Manuals.

G. Certificate of Completion and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

2. Certify in writing to the Owner and the AHJ that the fire alarm system has been installed in accordance with the approved fire alarm system drawings and applicable Codes.

3.5 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance and operating personnel who will be in charge of the system.

1. Provide instruction to the Owner's operating and maintenance personnel in the basic theories of operation of fire alarm systems with hands on training of the system operation.

2. Provide instruction to the Owner's maintenance personnel in the procedures and schedules involved in troubleshooting, servicing, and preventive maintenance of the system.

3. Provide a minimum of 4 hours, but not more than 8 hours, of training to be completed prior to final acceptance of the project.

4. Schedule training with the Owner at least seven days in advance at a time and place acceptable to the Owner.

* END OF SECTION 16720 *

Camp W.G. Williams
Building 5080
DFCM #07332480

SECTION 16740 - TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16110 - Raceways

C. Section 16140 - Electrical Boxes

1.2 SCOPE

A. Provide complete telecommunication service to each building including, but not limited to, telephone service cables, fiber optic service cables, cable splices, and cable terminations ready for connection to Owner furnished communication equipment as shown on the drawings and as specified herein.

B. Provide each building with Telephone/Data outlets, cables, terminations and equipment ready for connection to Owner furnished equipment as shown on the drawings and as specified herein.

C. Install all telecommunication system cables in approved raceway systems.

D. All telecommunication system work, exclusive of raceway system and outlet boxes, shall be provided by a single qualified installer (company) to establish a single source of responsibility for all telecommunications system work.

1.3 STANDARDS

A. TIA/EIA-568 - Commercial Building Wiring Standard.

B. TIA/EIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.

C. TIA/EIA-606 - Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.

D. NFPA 70-2008 - National Electrical Code

1.4 TELECOMMUNICATION CONTRACTOR QUALIFICATIONS

A. All telecommunication system work will be performed by a company regularly engaged in telecommunications systems installation and service with a documented work experience of not less than five years and with the following qualifications:

1. Personnel trained and certified in the design of the CommScope Systimax Cabling Solution.

2. Personnel trained and certified to install the CommScope Systimax Cabling Solution.

3. The Designer and Installer shall show proof of current certification of the CommScope Systimax Cabling Solution via an updated card given after attending the 5- day course or a re-certification class given every two years.

4. Provide references of the type of installation provided in this specification.

5. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using a light meter and OTDR.

6. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

7. Personnel trained and experienced in telecommunication systems using industry standard TIA/568B.

B. Certified CommScope Systimax companies in the state of Utah are:

1. **Americom Technology** Contact: Mark Monsen
5123 South Commerce Drive
Murray, UT 84107
Tel: 801-892-0529
FAX: 801-892-0585

2. **Cache Valley Electric** Contact: Tim Hadden
2345 South John Henry Dr
Salt Lake City, UT 84119
Tel: 801-908-2680
FAX: 801-908-7041

3. **Federal Communication** Contact: Justin Thomas
1990 South Milestone Drive, Suite D
Salt Lake City, UT 84104-4853
Tel: 801-972-2262
FAX: 801-972-9095

4. **Wasatch Electric** Contact: Ryan Wallwork
1574 South West Temple
Salt Lake City, UT 84155
Tel: 801-487-4511
FAX: 801-487-5032

C. Submit telecommunication system contractor, qualifications and CommScope Systimax Certification with required shop drawing submittals.

1.5 SUBMITTALS

A. Provide telecommunication system shop drawing submittals in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents and the above referenced standards.

1. Provide 1 additional set of Telecommunication submittals to be reviewed by the Utah National Guard State Telecommunications.

B. Provide descriptive literature to verify the Telecommunication Contractor Qualifications including, but not limited to the following:

1. Experience of communications system contractor including verifiable experience for

successful completion of projects using Industry Standard TIA/586B.
2. Qualifications of installing technician(s) including CommScope Systimax Certification.
3. Ability to provide The CommScope Systimax Warranty.

C. Telecommunication system drawings necessary to supplement telecommunication system work shown on the electrical drawings.

1. Include Building IDF backboard layout and typical wiring diagrams as required.

D. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for each of the following items:

1. Outside feed fiber optic cable.
2. Fiber optic termination cabinet.
3. Outside feed telephone cables
4. Telephone surge protection modules and fuses.
5. Telephone termination patch panel.
6. Inside wiring station cable.
7. Inside wiring station cable patch panel.
8. Telephone/Data outlet couplers and coverplates.

E. Above list is considered minimum. Additional items may be required to be submitted for review.

F. Incomplete submittals will be considered non-responsive and returned to the contractor for inclusion of missing items.

1.6 WARRANTY

A. Provide 1 Year warranty for the entire telecommunication system in accordance with the General Conditions and Division 1 Specification Sections.

B. Provide a twenty (20) year warranty available for the structured cabling system for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. Submit the CommScope warranty registration form upon completion of the installation. This will include all testing results.

1. Notify the Architect in writing of any changes or modifications to the contract documents required for the CommScope Systimax warranty prior to installation of the telecommunication system.

2. Submit copy of CommScope warranty registration form to the Architect prior to Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Telecommunication system material and products specified by name of manufacturer, brand or trade name or catalogue reference is intended to establish the type, quality, and performance characteristics required for this project and will be the basis of the bid and furnished under the contract unless changed in writing by the Architect. Where two or more materials are named, the choice of these will be optional with the Contractor.

B. Submit requests for substitution in writing to the Architect, with copy to the Engineer, in

accordance with the General Conditions.

1. Substitution of telecommunication system material and products will be limited to manufacturers and products acceptable to CommScope to provide the 20 year Warranty described above.

2.2 OUTSIDE FEED FIBER OPTIC CABLES

A. Provide multi-mode outside feed fiber optic cables consisting of 50 micron optical fibers with 125 micron cladding in a 3.0 mm filled buffer tube, a dielectric central member, water swellable yarn, and filler tubes as required, surrounded by a water swellable tape and strength members, with an overall medium density polyethylene jacket with ripcord.

B. Leave minium 20 foot maintenance loop of cable in each manhole.

2.3 FIBER OPTIC CABLE TERMINATION CABINETS

A. Terminate MDF fiber optic cables in a Secor (Corning Cable Systems) CCH-03U wall mounted interconnect center. Provide type CCH panels with SC compatible adapters and other accessories as required for the fiber optic cables to be terminated.

B. Terminate IDF fiber optic cables in a CommScope Systimax 600G2-1U-MOD-SD modular cassette shelf to accept 4 cassettes.

C. Provide CommScope Systimax MODG2-6SC-MM modular cassettes as required for termination of quantity of fiber optic strands installed.

D. Terminate each fiber optic strand with CommScope P6201B-Z-125 Type SC connectors.

E. Provide all necessary accessories for complete installation.

2.4 OUTSIDE FEED TELEPHONE CABLES

A. Provide outside feed telephone cables suitable for direct burial and underground duct installation conforming to the requirements of REA PE89.

1. Assembled cable shall consist of #24 AWG solid annealed copper conductors with color coded polyolefin insulation. Pairs shall be arranged into groups not exceeding 25 pairs with each group having a color coded unit binder.

2. The core assembly shall be completely filled to minimize water entry and flow. The filling compound shall be compatible with all other cable components and shall not drip from an exposed end of the cable.

3. A non-hygroscopic dielectric tape shall be applied longitudinally with overlap over the core assembly.

4. A corrugated, copolymer coated, 0.008" thick aluminum tape shall be applied with overlap over the dielectric. The sheath interfaces shall be flooding with an adhesive water blocking compound.

5. A black low density polyethylene jacket shall be applied over the completed cable assembly.

B. Do not splice telephone cables except where specifically indicated on the drawings. Additional splices must be approved in writing by the Owner.

C. Leave minium 20 foot maintenance loop of cable in each manhole.

2.5 TELEPHONE SURGE PROTECTION MODULES

A. Terminate MDF outside feed telephone cables at each Building 6170 in Avaya 107894966 100 pair surge protection module with 110 style terminations.

B. Terminate IDF outside feed telephone cables at each classroom building terminal backboard in a Marconi type R66P25QC 25 pair surge protection module with quick-connect clips, and connect to the building telephone termination patch panel.

C. Provide 104 410 147 gas protection fuses as required to protect all outside feed cable pairs.

D. Connect surge protection module to building electrical system ground with minimum #6 AWG insulated copper conductor.

2.6 TELEPHONE/DATA TERMINATION PATCH PANEL

A. Provide CommScope Systimax 110UB1-112FT patch panel kit with 4 pair connection blocks and 110U2R distribution rings as required for quantiy of tele/data cables to be terminated, 110UTC trough cover, and 110 UHD-S8 horizontal duct mounted to the bottom of patch panel.

B. Provide CommScope CPC5512-03F0XX and CPC5312-03F0XX stranded Cat 6, T586B patch cords of quantity and lengths required for the installation.

C. Provide all necessary accessories for complete installation.

2.7 TELEPHONE/DATA INSIDE WIRING STATION CABLE

A. Provide CommScope UltraMedia Category 6, Type 75N4, inside station wiring cables consisting of #23 AWG solid copper conductors individually insulated with minimum .008" (.20 mm) polyethylene, formed into twisted pairs, with pairs isolated by separator to form the cable core, and covered with a flame retardant PVC jacket with ripcord.

1. Provide telephone cables with yellow jacket and data cables with blue jacket and provide one of each cable color from each telephone/data outlet to the building terminal board.

B. Provide Cables which comply with National Electrical Code Article 800 for type CMR riser cables.

C. Provide cables which are UL Listed Category 6 in accordance with ANSI/EIA/TIA 568B.2-1.

D. Provide cables with band marked color coding for each twisted pair as follows:

1. Pair No. 1: Blue/White with blue tracer stripe
2. Pair No. 2: Orange/White with orange tracer stripe
3. Pair No. 3: Green/White with green tracer stripe
4. Pair No. 4: Brown/White with brown tracer stripe

2.8 TELEPHONE/DATA OUTLETS

A. Provide CommScope MGS400-262 GigaSpeed XL modular jacks with T568A/B wiring, and white

finish mounted in a CommScope M12L-262 two port single gang faceplate with white finish at each telephone/data outlet.

B. All jacks shall be suitable for ANSI/EIA/TIA 568 Category 6 applications.

2.9 TERMINAL BOARDS

A. Provide 3/4" thick, by 8 ft high CDX grade plywood terminal boards in as indicated on the drawings. Coat plywood terminal board with two coats of white fire retardant paint prior to installation of equipment and backboards.

2.10 RACEWAY SYSTEM

A. Provide a complete telephone/data raceway system as specified in Section 16110 - Raceways, except minimum raceway size will be 1" for Category 6 applications.

B. Provide an outlet box at each telephone/data outlet location as specified in Section 16130 - Electrical Boxes, except that minimum outlet box size will be 4" Square x 2-1/8" deep.

2.11 GROUNDING

A. Provide a #6 AWG insulated green ground conductor from the building to electrical service disconnect to the building terminal board and terminate in a ground terminal suitable for connection of not less than four #6 AWG copper conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all communications systems equipments, cables, outlets, etc., in accordance with the applicable ANSI/TIA/EIA Standards, National Electrical Code, and in accordance with the manufacturer's written installation instruction and recommendations.

3.2 PULL STRING

A. Provide a nylon or polypropylene pull string with not less than 200 lb tensile strength in all communication conduits. Leave 18 inches slack string coiled at each end of all raceways. Provide a hard cardboard tag for each raceway at all terminal boards, terminal cabinets, etc. to indicate location to which the raceway is connected.

3.3 COORDINATION

A. Coordinate installation of telecommunication system with the Utah National Guard (UTNG) prior to beginning work. Contact Mike Hansen (801) 523-4118.

B. Coordinate installation of raceway system with electrical contractor to provide required bending radius for cables, ample space for terminations, etc..

3.4 LABELING

A. Label each telephone/data outlet port, each cable at terminal board, and each port of modular patch panels with numbering system as designated by UTNG. Labels shall be printed self-adhesive labels as approved by the UTNG.

B. Label each outside feed communication cable in each manhole and at ech termination with identification of the location of the opposite end of the cable or cable designation as designated by owner. Labels shall be embossed aluminum or stainless steel tags attached to cable with cable tie wrap as approved by the UTNG

C. Provide additional labeling of communication equipment, cables, splices, etc., as recommended by TIA/EIA 606 Standards.

3.5 TESTING

A. The CommScope Systimax Certified telecommunication system technician shall provide testing of <u>each</u> communication cable after installation, terminations, and splices are completed to verify ability of the completed cable assembly to meet the applicable ANSI/TIA/EIA standards for the type of cable, meet the performance parameters published by the cable manufacturer, and verify eligibility for the CommScope 20 year warranty.

1. Individually test each pair of conductors for multi-conductor cables.
2. Individually test each fiber of fiber optic cables.
3. Test equipment shall be approved by CommScope for the 20 year warranty.

B. For cables which fail initial testing, replace cable terminations and/or splices and retest the cable. If more than two subsequent test failures occur, the cable shall be replaced without additional cost to the owner.

C. Provide a written test report for each tested cable and submit to UTNG and/or Engineer prior to Substantial Completion. Include copies of all test reports in the Operation and Maintenance Manuals.

* END OF SECTION 16740 *