STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

June 2, 2009

INFORMATION BOOTH

WEBER STATE UNIVERSITY

OGDEN, UTAH

DFCM Project Number: 08322810

Prior and Associates Architects LLC
821 Kensington Ave.
Salt Lake City, Utah

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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 Certification for Payment dated May 25, 2005.

Technical Specifications :
Drawings:

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

NOTICE TO CONTRACTORS

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

INFORMATION BOOTH
WEBER STATE UNIVERSITY – OGDEN, UTAH
DFCM PROJECT NO: 08322810

Bids will be in accordance with the Contract Documents that will be available on **Tuesday, June 2, 2009**, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Tim Parkinson, DFCM, at 801-450-2478. No others are to be contacted regarding this bidding process. The construction estimate for this project is $144,000.00.

A **mandatory** pre-bid meeting will be held at **10:00 AM on Monday, June 8, 2009** at Weber State University Facilities Management Office. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of **2:00 PM on Tuesday, June 16, 2009** at DFCM, 4ll0 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

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

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

PROJECT DESCRIPTION

Contractor is responsible for the construction of a new information booth as per the contract drawings and specifications.
The proposed project will consist of reconstructing the existing road way and building a small retaining wall near the road. Utilities may be constructed crossing the readway and that the concrete flatwork will be placed in the form of curb, gutter and sidewalks. The contractor will be responsible for the completion date of this project August 17, 2009.

PROJECT SCHEDULE

PROJECT NAME: INFORMATION BOOTH
WEBER STATE UNIVERSITY – OGDEN, UTAH
DFCM PROJECT NO. 08322810

Event	Day	Date	Time	Place
Bidding Documents Available	Tuesday	June 2, 2009	2:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-bid Site Meeting	Monday	June 8, 2009	10:00 AM	Weber State University Facilities Mngt. Office.
Last Day to Submit Questions	Wednesday	June 10, 2009	8:00 AM	Tim Parkinson – DFCM E-mail:tparkins@utah.gov Fax 801-538-3267
Addendum Deadline (exception for bid delays)	Monday	June 15, 2009	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Tuesday	June 16, 2009	2:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Wednesday	June 17, 2009	2:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Monday	August 17, 2009	5:00 PM	

* **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 "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **INFORMATION BOOTH – WEBER STATE UNIVERSITY – OGDEN, UTAH – DFCM Project #08322810** 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 August 17, 2009, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$250.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

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

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

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

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

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

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

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

2. Bids

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

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

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

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

3. Contract and Bond

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

4. Listing of Subcontractors

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

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

5. Interpretation of Drawings and Specifications

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

6. Addenda

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

7. Award of Contract

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

8. DFCM Contractor Performance Rating

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

9. Licensure

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

10. 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.

11. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

12. Time is of the Essence

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

13. Withdrawal of Bids

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

14. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of

the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. 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.

16. Debarment

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

BID BOND

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

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

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

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

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

DATED this _____ day of _____, 20_____ .

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

_____

_____

By: _____

Title: _____

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

_____

_____

By: _____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

STATE OF _____)
) ss.
COUNTY OF _____)

By: _____
Attorney-in-Fact (Affix Corporate Seal)

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

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

_____
NOTARY PUBLIC

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

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

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

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

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.

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 May 5, 2008 ("also referred to as General Conditions") 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 Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONTRACTOR: _____

_____
Signature Date

Title: _____

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
May 5, 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: _____

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

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

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

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

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

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

_____

_____

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

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

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

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

_____ by: _____

CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____

A/E (include name of firm) (Signature) DATE

_____ by: _____

USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____

DFCM (Owner) (Signature) DATE

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

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

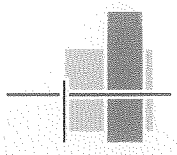
Additional Comments:

Technical Specification For

Weber State University
New Information Booth
Division of Facilities Construction Management Project Number 08322810

11 May 2009

P+A Architects
821 Kensington Avenue
Salt Lake City, Utah 84105



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SECTION 01010 - SUMMARY OF WORK

1.1 GENERAL

A. The Project consists of existing site demolition and new construction of a new information building. Work includes concrete, masonry, wood framing, curb and gutter, new roofing electrical, mechanical and structural as shown on construction documents.

1. Project Location: Weber State University – New Information Booth
2. Owner: Weber State University, Utah Valley University

B. Contract Documents, dated May 6th 2009, were prepared for the project by P+A architects, located at 821 East Kensington Avenue, Salt Lake City, Utah

C. The Work will be constructed under a single prime contract.

D. Use of the Site: Limit use of premises to areas indicated on construction documents. Do not disturb portions of the site beyond the areas indicated.

1. Allow for Owner occupancy and use by the public.
2. Keep driveways and entrances clear. Do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.

1.2 CONTRACTOR USE OF PREMISES

A. General: During the construction period, the Contractor shall have use of the premises for construction operations as shown on construction documents. Parking and contractor staging at the site is limited and will be reviewed at the pre bid conference.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to other occupants and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

2. The general contractor shall provide 72 hours notice prior to shutting down any mechanical or electrical items that affect other areas in the building.

3. The general contractor shall provide protection of the existing elevator walls when using the elevators.

4. All interior corridors are to remain clear during the construction process.

5. The general contractors shall inform the owner, architect and D.F.C.M at least 36 hours prior to all work that will create sufficient noise that could disturb other classroom areas within the building.

END OF SECTION 01010

SECTION 01027 - APPLICATIONS FOR PAYMENT

1.1 GENERAL

A. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

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

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

   a. Contractor's Construction Schedule.
   b. Application for Payment forms, including Continuation Sheets.
   c. List of subcontractors.
   d. List of products.
   e. List of principal suppliers and fabricators.
   f. Schedule of submittals.

2. Submit the Schedule of Values at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.

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

1. Include the following Project identification:

   a. Project name and location.
   b. Name of Architect.
   c. 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 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.
   h. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate evaluation of Applications for Payment. Break subcontract amounts down into several line items. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
4. Provide a separate line item for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

5. Provide separate line items for initial cost of the materials, for each subsequent stage of completion, and for total installed value.
6. Show line items for indirect costs and margins on costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

    a. Temporary facilities and items that are not direct cost of work-in-place may be shown as separate line items or distributed as general overhead expense.

7. Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives change the Contract Sum.

D. Applications for Payment shall be consistent with previous applications and payments as certified by the Owner and paid for by the Owner.

E. Payment-Application Times: Payment dates are indicated in the Agreement. The period covered by each application is the period indicated in the Agreement.

F. Payment-Application Forms: Use DFCM form for Applications for Payment.

G. Application Preparation: Complete every entry, including notarization and execution by a person authorized to sign on behalf of the Contractor. The owner will return incomplete applications without action.

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

H. Transmittal: Submit 3 executed original copies of each Application for Payment to the ownerwithin 24 hours. One copy shall be complete, including waivers of lien and similar attachments.

1. Transmit each copy with a transmittal listing attachments and recording appropriate information related to the application.

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

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Submit each Application for Payment with Contractor's waiver of lien for the period of construction covered by the application.

    a. Submit final Applications for Payment with final waivers from every entity involved with performance of the Work covered by the application who may file a lien.

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

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

1. List of subcontractors.

2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Submittal Schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. Copies of building permits.
8. Copies of licenses from governing authorities.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.

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

1. Administrative actions and submittals that shall precede or coincide with this application include the following:

a. Occupancy permits.
b. Warranties and maintenance agreements.
c. Maintenance instructions.
d. Meter readings.
e. Changeover information related to Owner's occupancy.
f. Final cleaning.
g. Application for reduction of retainage and consent of surety.

L. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Transmittal of Project construction records to the Owner.
4. Removal of temporary facilities and services.
5. Change of door locks to Owner's access.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01040 - COORDINATION

1.1 GENERAL

A. This Section includes requirements for coordinating construction operations including, but not necessarily limited to, the following:

1. Coordination drawings.
2. Administrative and supervisory personnel.
3. Cleaning and protection.

1.2 COORDINATION

A. Coordinate construction to assure efficient and orderly installation of each part of the Work. Coordinate operations that depend on each other for proper installation, connection, and operation.

1. Schedule operations in the sequence required to obtain the best results where installation of one part depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining procedures required for coordination. Include such items as required notices and reports.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

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

1. Preparation of schedules.
2. Delivery and processing of submittals.
3. Progress meetings.
4. Project closeout activities.

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

E. Staff Names: Within 10 days of commencement of construction, submit a list of the Contractor's staff assignments, including the superintendent and other subcontractors at the Project. Identify individuals and their responsibilities. List their addresses and telephone numbers.

1.3 PRODUCTS (Not Applicable)

1.4 EXECUTION

A. Inspection of Conditions: Require Installers of major components to inspect substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.

B. Clean and protect construction in progress and adjoining materials, during handling and installation. Apply protective covering to assure protection from damage.

C. Clean and maintain completed construction as necessary through the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

D. Limiting Exposures: Supervise construction to assure that no part is subject to harmful, dangerous, or damaging exposure. Such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Water or ice.
5. Solvents and chemicals.
6. Abrasion.
7. Soiling, staining, and corrosion.
8. Combustion.
9. Wind.

END OF SECTION 01040

SECTION 01400 - QUALITY CONTROL

1.1 GENERAL

A. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities.

B. Contractor Responsibilities: Unless they are the responsibility of another entity, Contractor shall provide inspections and tests specified elsewhere and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.

1. Where inspections and tests are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform these services. Costs for these services are included in the Contract Sum.

C. Retesting: The Contractor is responsible for retesting where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements.

1. The cost of retesting is the Contractor's responsibility where tests performed indicated noncompliance with requirements.

D. Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify the agency in advance of operations to permit assignment of personnel. Auxiliary services include the following:

1. Providing access to the Work.
2. Furnishing incidental labor and facilities to assist inspections and tests.
3. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
4. Providing facilities for storage and curing of test samples.
5. Delivering samples to testing laboratories.
6. Providing preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Providing security and protection of samples and test equipment.

E. Duties of the Testing Agency: The testing agency shall cooperate with the owner and the Contractor in performing its duties. The agency shall provide qualified personnel to perform inspections and tests.

1. The agency shall notify the owner and the Contractor of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency shall not release, revoke, alter, or enlarge requirements or approve or accept any portion of the Work.
3. The agency shall not perform duties of the Contractor.

F. Coordination: Coordinate activities to accommodate services with a minimum of delay. Avoid removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling inspections, tests, taking samples, and similar activities.

G. Submittals: The testing agency shall submit a certified written report, in duplicate, of each inspection and test to the Owner. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection or test through the Contractor.

1. Submit additional copies of each report to the governing authority, when the authority so directs.
2. Report Data: Reports of each inspection, test, or similar service include, but are not limited to, the following:

a. Date of issue.
b. Project title and number.
c. Name, address, and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample taking and testing.
k. Comments or professional opinion on whether inspected or tested Work complies with requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.

H. Qualifications for Service Agencies: Engage inspection and testing service agencies that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each agency shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Repair and Protection: Upon completion of inspection, testing, and sample taking, repair damaged construction. Restore substrates and finishes. Comply with Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection and testing.

END OF SECTION 01400

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY 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 construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

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

1. Water service and distribution.
2. Temporary electric power and light.
3. Temporary heat.
4. Ventilation.
5. Sanitary facilities, including drinking water.
6. Storm and sanitary sewer.

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

1. Storage sheds.
2. Dewatering facilities and drains.
3. Temporary project identification signs and bulletin boards.
4. Waste disposal services.

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

1. Temporary fire protection.
2. Barricades, warning signs, and lights.
3. Sidewalk bridge or enclosure fence for the site.

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.

3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

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

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

B. Water: Provide potable water approved by local health authorities.

C. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

H. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 TEMPORARY UTILITY INSTALLATION

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

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary 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 disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

G. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

J. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

K. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access. Field offices are not required unless the general contractor wishes to provide one.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

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

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

E. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

F. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but 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 fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

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

D. Enclosure Fence: Before mobilization begins, install a tortoise barrier fence with barrier gates. Locate where indicated. Enclose the entire site as shown on drawings. Install in a manner that will prevent tortoise and other animals from easily entering the site.

1. See architectural site plan

E. If the general contractor wishes to provide a security enclosure they may do so. Security of the site and construction materials, equipment and all items on site is the responsibility of the general contractor.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage 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. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when 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 the 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 Contractor's property.
   a. At Substantial Completion, clean permanent facilities.

END OF SECTION 01500

SECTION 01700 - CONTRACT CLOSEOUT

1.1 GENERAL

A. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

B. Substantial Completion: Before requesting inspection for certification of Substantial Completion, complete the following:

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the Work claimed as substantially complete.

    a. Include supporting documentation for completion and an accounting of changes to the Contract Sum.

2. Advise the Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
5. Deliver tools, spare parts, extra stock, and similar items.
6. Changeover locks and transmit keys to the Owner.
7. Complete startup testing of systems and instruction of operation and maintenance personnel.
8. Complete final cleanup requirements, including touchup painting.
9. Touch up and repair and restore marred, exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Project Manager will proceed or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Project Manager will repeat inspection when requested and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

D. Final Acceptance: Before requesting inspection for certification of final acceptance and final payment, complete the following:

1. Final payment request with releases and supporting documentation. Include insurance certificates where required.
2. Submit a statement, accounting for changes to the Contract Sum.
3. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
4. Submit consent of surety to final payment.
5. Submit a final settlement statement.
6. Submit evidence of continuing insurance coverage complying with insurance requirements.

E. Reinspection Procedure: The owner will reinspect the Work upon receipt of notice that the Work has been completed, except for items whose completion is delayed under circumstances acceptable to the owner.

1. Upon completion of reinspection, the owner will prepare a certificate of final acceptance. If the Work is incomplete, the owner will advise the Contractor of Work that is incomplete or obligations that have not been fulfilled but are required.
2. If necessary, reinspection will be repeated.

F. Record Document Submittals: Do not use record documents for construction. Protect from loss in a secure location. Provide access to record documents for the owners's reference.

G. Record Drawings: Maintain a set of prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the drawing most capable of showing conditions fully and accurately. Give attention to concealed elements.

1. Mark sets with red pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Organize record drawing sheets into manageable sets. Bind with durable-paper cover sheets; print titles, dates, and other identification on the cover of each set.

H. Record Specifications: Maintain one copy of the Project Manual, including addenda. Mark to show variations in Work performed in comparison with the text of the Specifications and modifications. Give attention to substitutions and selection of options and information on concealed construction. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the owner for their records.

I. Maintenance Manuals: Organize operation and maintenance data into sets of manageable size. Bind in individual, heavy-duty, 2-inch (51-mm), 3-ring, binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the following information:

1. Copies of warranties.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Operation and Maintenance Instructions: Include a detailed review of the following items:

1. Maintenance manuals.

B. As part of instruction for operating equipment, demonstrate the following:

1. Startup and shutdown.
2. Noise and vibration adjustments.

C. Final Cleaning: Employ experienced cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Complete the following operations before requesting inspection for certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Leave concrete floors broom clean.

3. Wipe surfaces of electrical equipment. Remove excess lubrication. Clean light fixtures and lamps.
4. Clean the site of rubbish, litter, and foreign substances. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds to a smooth, even-textured surface.

D. Removal of Protection: Remove temporary protection and facilities.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials and dispose of lawfully.

END OF SECTION 01700

SECTION 01740 - WARRANTIES

1.1 GENERAL

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

G. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
2. Where the Contract Documents require a special warranty, or similar commitment, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

H. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Owner's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties upon request of the Owner's.

I. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

J. Bind warranties and bonds in heavy-duty, commercial-quality, durable 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.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Schedule: Provide warranties on products and installations as specified in the following Sections:

END OF SECTION 01740

SECTION 02056

EMBANKMENT, BORROW, AND BACKFILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for construction of embankment, backfill, and bridge approach embankments.

1.2 RELATED SECTIONS

A. Section 02231: Site Clearing and Grubbing

B. Section 02317: Structural Excavation

C. Section 02912: Topsoil

D. Section 03575: Flowable Fill

1.3 REFERENCES

A. AASHTO M 145: Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

B. AASHTO T 11: Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

D. AASHTO T 99: Moisture-Density Relations of Soils Using a 2.5 kg (5.5-lb) Rammer and a 305 mm (12 inch) Drop

E. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop

F. UDOT Minimum Sampling and Testing Requirements

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Submit the following before delivering material to the project:
   1. Supplier and source of materials

2. Gradation analysis AASHTO T 27 and T 11
3. Soil classification when applicable AASHTO M 145
4. Maximum Dry Density and Optimum Moisture Determination
    a. Use AASHTO T 180 Method D for A-1 soils and AASHTO T 99 Method D for all other soils.

1.6 ACCEPTANCE

A. Acceptance sampling and testing of material is in accordance with UDOT Minimum Sampling and Testing Requirements.

B. Engineer reserves the right to select and test material randomly from any location at the construction site.

C. Density Requirement: Acceptance is on a lot-by-lot basis when average density is not less than 96 percent of maximum laboratory density and no single determination is lower than 92 percent.
    1. Use AASHTO T 180 Method D for A-1 soils and AASHTO T 99 Method D for all other soils.

D. Remove any material found defective and replace with acceptable material at no additional cost to the Department.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials free of contamination from chemical or petroleum products for embankment and backfill placements. Materials may include recycled portland cement concrete.

2.2 BORROW

A. Classifications A-1-a through A-4. Meet AASHTO M 145

2.3 GRANULAR BORROW

A. Classification A-1-a. Meet AASHTO M 145

B. Non-plastic, well-graded, 3-inch maximum

2.4 GRANULAR BACKFILL BORROW

A. Classification A-1-a. Meet AASHTO M 145

B. Non-plastic, well-graded, 2-inch maximum

2.5 EMBANKMENT FOR BRIDGE

A. Granular Borrow

2.6 FREE DRAINING GRANULAR BACKFILL

A. Meet the following gradation:

Table 1

Free Draining Granular Backfill Gradation	
Sieve Size	**Percent Passing**
1½ inch	100
1 inch	95 to 100
½ inch	25 to 60
No. 4	0 to 10

2.7 FLOWABLE FILL

A. Refer to Section 03575

PART 3 EXECUTION

3.1 PREPARATION

A. Complete clearing and grubbing and stripping and stockpiling topsoil before placing embankment. Refer to Sections 02231 and 02912.

B. Excavate and dispose of unsuitable material as directed by the Engineer.

3.2 EMBANKMENT PLACEMENT

A. Place roadway excavation or borrow in embankment section with the highest quality material in the top portion of the embankment.

B. Scarify and compact the top 8 inches of the surface to at least 90 percent of maximum laboratory density when the embankment height is 6 ft or less and the underlying ground consists of loose material.

C. Break and scarify all underlying road surfaces in so that pieces do not exceed 3 ft^2.

D. Maintain drainage.
1. Grade and maintain the roadway to ensure adequate drainage.

2. Maintain pipe culverts and drainage ditches, or provide temporary facilities when interrupting irrigation systems, sewer, underdrainage, etc.

E. Place an initial layer to act as a working platform over soft, wet ground when approved by the Engineer.
   1. Density specifications do not apply to the working platform.
   2. Meet density requirements for embankment placed above the working platform.

F. The Engineer inspects and accepts the working platform or foundation before embankment is placed.

G. Spread embankment materials uniformly in layers not exceeding 1 ft (uncompacted depth) and compact to an average of 96 percent maximum laboratory density before placing the next layer. Reduce the lift thickness if tests show unsatisfactory density.

H. Finish subgrade surface within ±0.1 ft of line and grade.

I. Do not use rock or pavement materials over 3 ft in any dimension. Distribute so space exists for placing and compacting embankment material between large rocks or pavement materials.

J. Do not place large rock within 1 ft of the subgrade surface. Do not allow rocks to protrude above the subgrade surface.

K. Do not use compacting equipment that causes shear failure in the embankment.

3.3 GRANULAR BORROW AND BACKFILL PLACEMENT

A. Finish granular borrow surface within ±0.1 ft of line and grade.

B. Compact borrow and backfill material in 6-inch layers to a 96 percent density.

C. Structural Backfill Placement includes bridges, foundation, box culverts, pipe culverts, drains and other structures.
   1. Place suitable backfill material in structural backfill sections. Refer to Section 02317.
      a. Use granular backfill borrow when specified.
   2. Use appropriate compaction equipment adjacent to abutments, backwalls, approach slabs, wing walls, retaining walls, and other structures.

D. Free Draining Granular Backfill
   1. Excavate a trench 3 inches below the underdrain pipe flow-line. Widen to 2 ft plus the outside diameter of the underdrain pipe.
   2. Place free draining granular backfill in the trench and compact the bottom 3 inches with two passes of a vibratory roller.
   3. Back fill to 12 inches above top of pipe with free draining granular backfill.

3.4 EMBANKMENT FOR BRIDGE PLACEMENT

A. Construct approach embankments from the original existing ground up with the specified material to the limits defined herein and in accordance with DD series Standard Drawings.
   1. Approach Embankments
      a) Place embankment beneath the bridge except riprap or other specified materials used for MSE walls.
      b) Place embankment from the bridge abutment centerline station to a point measured at least 300 ft away from the abutment along the approach roadway centerline and placed for embankment on the inside of abutments.
      c) Use the specified material throughout the length of the walls where retaining walls are located beyond this delineation.
   2. Intersecting Roadway Embankments
      a) Place embankment from approximate edge of approach roadway at least 60 ft along intersecting roadway centerline.
   3. Adjoining Embankments
      a) Place embankment at least 10 ft outward from edge of approach roadway pavement when adjoining embankment is not an approach embankment.

B. Over-excavate unsuitable material such as soft, springy, organic, or otherwise yielding material at natural ground level as directed by the Engineer.

C. The Engineer inspects and accepts the working platform or foundation before embankment is placed.

D. Spread embankment materials uniformly in layers not exceeding 1 ft (uncompacted depth) and compact to an average of 96 percent maximum laboratory density before placing the next layer. Reduce the lift thickness if tests show unsatisfactory density.

E. Finish surface within ±0.1 ft of line and grade.

3.5 LIMITATIONS

A. Requirements when working during freezing or snowy conditions:
   1. Do not place embankment on frozen or snow-covered areas.
   2. Do not deliver or use frozen material in embankments.
   3. Remove snow and frozen material from embankments, foundations, and borrow areas, and furnish embankment material that can be compacted to the specified density.
   4. Remove waste and replace frozen embankment material at no additional cost to the Department.
   5. Measure wasted material and provide quantities to the Engineer.

END OF SECTION

SECTION 02221

REMOVE STRUCTURE AND OBSTRUCTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove, dispose of, or salvage buildings, fences, structures, pavements, curb, gutter, driveways and approaches, sidewalk and similar hard surfaces, abandoned pipelines or utility items and other obstructions that interfere with construction on or off the site including, but not limited to, foundations, bridges, culverts, guardrail, concrete work, septic tanks, trees, etc.

B. Salvage as specified, or dispose of in an approved manner.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work

B. Section 01355: Environmental Protection

C. Section 02056: Embankment, Borrow, and Backfill

D. Section 02705: Pavement Cutting

E. Section 03055: Portland Cement Concrete

1.3 REFERENCES **Not Used**

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS **Not Used**

1.6 PROJECT SITE CONDITIONS

A. Protect adjacent structures and utilities and their contents that are designated to remain.

PART 2 PRODUCTS

2.1 CONCRETE

A. Use Class A Concrete. Refer to Section 03055.

2.2 COMMON FILL

A. Refer to Section 02056.

PART 3 EXECUTION

3.1 PREPARATION

A. Review all work procedures with Engineer.

B. Coordinate utility location in accordance with Section 00727.
   1. Locate and protect all active utilities.
   2. Before beginning work:
      a. Notify Engineer.
      b. Notify all affected utilities.
      c. Blue Stake the area.

C. Restore utility services disturbed by construction operations.

D. Disconnect water service by excavating to the corporation stop and turning it off. Disconnect the service line from the corporation stop.

E. Plug disconnected storm drains or sewer lines near the right-of-way line with a watertight concrete plug extending at least 2 ft into the remaining pipe.

F. Remove existing septic tanks, cesspools, leach lines, etc.

G. All materials not designated for use or salvage become the property of the Contractor unless owned by a utility company.

H. Excavate all material necessary to permit removal of structure.

3.2 BACKFILL AND COMPACTION

A. Fill all holes or pits resulting from removal operations with suitable material.

B. Compact the backfilled areas to the density of the surrounding ground, or as specified.

C. Department will pay separately for Roadway Excavation or Borrow material used for backfill. Material items not included in the bid proposal will be considered incidental to the work.

3.3 REMOVAL AND DISPOSAL

A. Remove and dispose of all material promptly using methods acceptable to the Engineer and in accordance with all applicable rules and regulations.
   1. Include all excavation, removal, transportation, and disposal costs in the item of work.

B. Repair any damage to adjacent area at no additional cost to Department.

C. Remove all concrete to at least 2 ft below the finished grade, or 2 ft below the natural ground surface, whichever is lower.

D. Obtain all required permits and provide an environmentally safe area for disposal of removed items. Refer to Section 01355.

E. Dispose of removed obstructions at a site secured by the Contractor. Furnish the Engineer with a copy of the disposal permits or agreements.

3.4 BUILDING, BASEMENT, AND FOUNDATION DEMOLITION

A. Move or demolish designated buildings including basements, foundations, sidewalks, pavement slabs, porches, fences and outbuildings on each parcel.

B. The Department is not responsible for any vandalism or theft that occurs to the building or its contents that reduces the value of the salvage or increases the cost of removal after the award of the Contract.

C. Break the floor into pieces not over 3 ft^2 in areas to remain in place. Remove and dispose of pieces over 3 ft^2.

3.5 BRIDGE AND BOX CULVERT DEMOLITION

A. Arrange detours for traffic flow according to traffic control plans.

B. Excavate all material necessary to permit removing structure.

C. Remove structure so that no remaining portion is closer than 3 ft to any watercourse or closer than 2 ft to the subgrade and embankment surface or within 2 ft of the natural ground surface.

D. Remove all structures that will interfere with proposed construction.

E. Complete blasting or other removal operations of existing structure that may damage new construction before placing the new work.

3.6 REMOVE CONCRETE SLOPE PROTECTION

A. Remove portions of the existing slope protection and the cutoff wall where required.

B. Obtain the Engineer's approval of the concrete slope protection removal limits.

C. Saw cut the existing slope protection to full depth.

D. Do not damage the portions of concrete slope protection that are to remain.

E. Dispose of the removed material in an environmentally safe area.

3.7 MANHOLE, CLEANOUT, DIVERSION BOX, AND CATCH BASIN REMOVAL

A. Maintain satisfactory by-pass service during construction operations.

B. Plug unused sewers with a 2 ft long concrete plug.

3.8 CATTLE GUARD REMOVAL

A. Remove the cattle guard to at least 2 ft below the subgrade surface.

B. Excess materials become the Contractor's property unless otherwise designated.

3.9 SEPTIC TANK AND UNDERGROUND TANK REMOVAL

A. Empty and dispose of tank contents in accordance with Section 01355.

B. Break down and remove tank and appurtenances to at least 2 ft below the subgrade surface or finished ground lines.

C. Break the floor into pieces not over 3 ft^2 in area.

3.10 BURIED FUEL TANK DEMOLITION

A. Remove buried fuel storage tanks and dispose of tank contents in accordance with all applicable Laws and Regulations.

B. Do not spill fuel on subgrade.

C. Comply with the State and local authorities having jurisdiction over fuel tank removals.

3.11 GUARDRAIL REMOVAL

A. Remove and dispose of guardrail, posts, hardware, anchor assemblies, terminal assemblies, and attached posts, signs, and delineators.

B. Remove steel posts to a minimum of 8 inches below the subgrade surface or finished ground lines.

3.12 FENCE REMOVAL

A. Prevent people or livestock from entering work site from adjacent properties during removal and installation procedures.

B. Remove fence, posts, and foundations to at least 2 ft below subgrade or finished ground lines.

C. Do not damage vegetation and ground cover during removal operations.

3.13 RAILROAD TRACK REMOVAL

A. Remove all rails, ties, paving, track encasement, and other appurtenances.

B. Leave crushed stone or gravel ballast. Grade as required.

3.14 TREE REMOVAL

A. Remove all trees with a circumference larger than 20 inches measured at a point 2 ft above existing ground.
   1. A tree consists of stump, root, trunk, branches, and foliage.
   2. Multiple leaders rising from a common root will not be counted separately.
   3. Remove the root system to a minimum depth of 2 ft below the finished ground level and within a 2 ft radius of the stump.

4. When there is no bid item included in the proposal for Tree Removal:
   a. This work is considered incidental to other items of work and no separate measurement or payment will be made.
   b. Include all costs in other items of work.

B. Trees removed with a circumference 20 inches or less measured at 2 ft above existing ground are considered incidental construction.

3.15 CONCRETE HEADWALL REMOVAL

A. Remove headwalls where designated.

B. Replace pipes or structural plate pipes damaged while removing headwall at no additional cost to the Department.

3.16 UTILITY POLE REMOVAL

A. Remove pole and all appurtenances.

B. Remove foundation to at least 2 ft below subgrade or natural ground.

3.17 PIPE CULVERT REMOVAL

A. Excavate all material necessary to permit removing pipe culvert, end sections, headwalls, etc.

B. Plugs:
   1. Cut existing pipe culvert 2 ft inside the Department's right-of-way, and abandon culvert located on private property.
   2. Plug disconnected pipelines near the right-of-way line with a water-tight concrete plug extending into the remaining pipe at least 2 ft.

C. Seal openings in walls of remaining manholes or catch basins with watertight concrete plug.

3.18 PAVEMENT REMOVAL

A. Cut existing pavement on the designated lines with straight vertical edges free from irregularities when joining new construction to existing pavement. Refer to Section 02705.

B. Completely remove pavement down to the underlying base course or subgrade.

3.19 OBLITERATE ROAD

A. Break up pavement into pieces not over 1 ft^2 in area. Scarify and cover broken concrete with at least 1 ft of suitable backfill material.

B. Fill depressions and form rounded slopes to blend with the natural or surrounding contours.

C. Grade materials either along the toe of an embankment or into a depression or borrow pit. Cover with at least 1 ft of suitable backfill material.

3.20 CONCRETE SIDEWALK AND CONCRETE DRIVEWAY REMOVAL

A. Remove concrete to the nearest expansion joint or saw cut to provide proper grades and connections.

B. Make concrete cuts straight, vertical to the surface, full depth, and free from irregularities. Refer to Section 02705.

C. Do not damage concrete designated to remain.

3.21 CONCRETE CURB, CONCRETE CURB AND GUTTER, RAISED ISLAND, AND BITUMINOUS CURB REMOVAL

A. Remove curb, curb and gutter, gutters, raised island, bituminous curb, and parts of such improvements to an existing joint or joint sawed with a vertical face.

B. Remove material to provide proper grades and connections.

3.22 SALVAGE

A. Salvage designated equipment and materials.

B. All other materials become the property of the Contractor unless otherwise noted.

END OF SECTION

SECTION 02312

GRADING FOR LANDSCAPES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for landscape grading.

1.2 RELATED SECTIONS

A. Section 02056: Embankment, Borrow, and Backfill

B. Section 02912: Topsoil

1.3 REFERENCES Not Used

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS Not Used

1.6 QUALITY ASSURANCE

A. Landscape grading is aesthetic by nature and subject to continual monitoring and modification during backfilling. Work closely with Engineer particularly when grading and constructing berms, channels, or other aesthetic structures.

1.7 PAYMENT PROCEDURES

A. When there is no bid item included in the proposal for Grading for Landscapes:
   1. This work is considered incidental to other items of work and no separate measurement or payment will be made. Include all costs in other items of work.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. Provide soils that comply with Section 02056 for fill areas that are to be landscaped.

B. Topsoil: Refer to Section 02912.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required line, levels, contours, and datum.

3.2 PROTECTION

A. Protect existing trees, shrubs, lawns, structures, fences, roads, sidewalks, paving, curb and gutter, and other features.

3.3 CLEANING

A. Remove stockpiles from the site. Grade site surface to prevent freestanding surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 02316

ROADWAY EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavation of all material within designated areas.

B. Rock excavation and removal.

C. Placement of excavated material in embankment and other areas.

1.2 RELATED SECTIONS

A. Section 00725: Scope of Work

B. Section 00820: Legal Relations and Responsibility to the Public

C. Section 01355: Environmental Protection

D. Section 01571: Environmental Controls

E. Section 01721: Survey

F. Section 02056: Embankment, Borrow, and Backfill

G. Section 02075: Geotextiles

H. Section 02231: Site Clearing and Grubbing

I. Section 02705: Pavement Cutting

J. Section 02912: Topsoil

1.3 REFERENCES

A. National Fire Protection Association (NFPA) Standards

B. UOSH Construction Standards

1.4 DEFINITIONS

A. Rock: Material that cannot be excavated and removed without blasting, chipping, cutting, or ripping.

1.5 SUBMITTALS

A. Submit proposed method of blasting, delay pattern, explosive types, and type of blasting mat cover.

1.6 ACCEPTANCE AND PAYMENT PROCEDURES

A. Payment is plan quantity by the cubic yard. If staked quantities differ by 5 percent or less make no adjustment to plan quantities.

B. Notify the Engineer in writing before beginning excavation in any area if the Contractor determines that the staked quantities differ from the plan quantities by more than 5 percent. The following procedures then apply:
   1. Provide calculations and plots in accordance with Section 01721.
   2. Evaluate the "plan quantities" to "staked quantities" by individual cuts or balances as determined by the Engineer to provide the necessary accuracy.
   3. Do not begin excavation of any cut sections that the Contractor determines to differ from plan quantities by more than 5 percent until the calculations and plots have been submitted, reviewed, and approved by the Engineer. No payments, partial or final will be made until submissions are provided and approved.

C. Approved quantities become the adjusted plan quantities and are paid at the original unit bid price when the Engineer determines the staked quantities differ from plan quantities by more than 5 percent.

D. Payment includes excavation, removal, transportation, and disposal when existing pavement is included in Roadway Excavation plan quantity.

PART 2 PRODUCTS

2.1 MATERIALS FOR OVER-EXCAVATED AREAS

A. Refer to Section 02056

B. Geotextile Fabric: Refer to Section 02075

2.2 USE OF ON-SITE MATERIALS

A. Refer to Section 00725.

2.3 EXPLOSIVES

A. Use explosives, delay fuses, and all blasting materials as recommended by the explosives firm. Refer to NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

PART 3 EXECUTION

3.1 PREPARATION AND PROTECTION

A. Refer to Sections 00820 and 01571.

B. Locate and protect utilities as necessary.

C. Clear and grub within the designated area before starting excavation. Refer to Section 02231.

3.2 BLASTING MATERIAL STORAGE

A. Store all explosives securely in compliance with Laws and Regulations. Refer to Section 00820. Refer to NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

B. Mark all storage places clearly.

3.3 TOPSOIL

A. Remove topsoil in accordance with Section 02912.

3.4 DEWATERING

A. Keep excavation free from surface and ground water through all stages of construction.
   1. Maintain adequate drainage during all stages of construction through pumping, pipe culverts and drainage ditches.
   2. Provide temporary facilities when interrupting irrigation systems, sewer, underdrainage, etc.

3.5 EXCAVATION – STANDARD PROCEDURES

A. Finish excavation to reasonably smooth and uniform surface.

B. Provide and maintain satisfactory access to roads, streets, and adjacent property during all phases of construction according to the Traffic Control Plan.

C. Remove material in all cut sections to the depth shown. Scarify to an 8-inch depth and compact to at least 96 percent of maximum laboratory density when necessary to obtain compaction. Refer to Section 02056.

D. Excavate and waste unsuitable material.

E. Material for backfilling or finishing.
   1. Use suitable granular material encountered in excavation to construct the top layers of embankment, finishing the roadbed, or backfill when directed by the Engineer.
   2. Haul the granular material directly from excavation to the final position on the roadbed when practical.

3.6 ROCK REMOVAL – NONEXPLOSIVE METHOD

A. Excavate solid rock 6 inches to 1 ft below subgrade and backfill with acceptable material.
   1. Rock removed more than 1 ft below subgrade will not be measured or paid for.
   2. Backfilling of depth greater than 1 ft below subgrade will not be measured or paid for.

3.7 ROCK REMOVAL – EXPLOSIVE METHOD

A. Comply with UOSH Constructions Standards Chapter U rules and regulations.

B. Comply with NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

C. Provide a qualified explosives expert to act as an advisor and consultant during drilling and blasting operations.

D. Do not blast beyond designated areas.

3.8 ROCK FACES

A. Scale rock cuts of all loose rocks and fragments and leave in a neat and safe condition.

3.9 PAVEMENT

A. Cut existing pavement on the designated lines with straight vertical edges free from irregularities when joining new construction to existing pavement. Refer to Section 02705.

B. Excavate all pavement according to plans.

C. Dispose of pavement using methods acceptable to the Engineer in accordance with all applicable rules and regulations and as follows:
   1. Inside the right-of-way as embankment, subject to the approval of the Engineer. Refer to Section 02056.
   2. Outside the right-of-way subject to the approval of the Engineer. Refer to Section 01355. Furnish the Engineer with copies of the disposal permits, agreements, or both.

END OF SECTION

SECTION 02721

UNTREATED BASE COURSE (UTBC)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Production, construction, and compaction of UTBC used for pavements, shoulders, and incidental construction.

1.2 RELATED SECTIONS

A. Section 01572: Dust Control and Watering

1.3 REFERENCES

A. AASHTO T 11: Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

B. AASHTO T 19: Bulk Density ("Unit Weight") and Voids in Aggregate

C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

D. AASHTO T 89: Determining the Liquid Limit of Soils

E. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils

F. AASHTO T 96: Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

G. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop

H. AASHTO T 193: The California Bearing Ratio

I. AASHTO T 255: Total Evaporable Moisture Content of Aggregate by Drying

J. AASHTO TP 61: Determining the Percent of Fracture in Coarse Aggregate

K. UDOT Minimum Sampling and Testing Requirements

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Submit a written report for approval for each aggregate class and source, a minimum of five working days prior to placement. Include the following:
   1. Aggregate suitability. Refer to this Section, Part 2, Products.
   2. Name of supplier and location of source.
   3. Maximum Dry Density and Optimum Moisture Content. Refer to AASHTO T 180, Method D.
   4. Job mix gradation including single values for each sieve size, No. 4 and finer, within the gradation limits of Table 2.

1.6 ACCEPTANCE

A. Acceptance sampling and testing of material is in accordance with UDOT Minimum Sampling and Testing Requirements.

B. Type I Placement – Pavement Section includes placement for Curb or Curb and Gutter when in conjunction with placement for pavement section.
   1. Use Class A aggregate, Table 1.
   2. The Engineer takes random samples from the grade and tests for moisture, gradation, and laboratory density, and performs In-place Density determinations.
   3. Meet gradation limits and applicable tolerances of Table 2 for each gradation test. Each sublot will be evaluated separately and not averaged with other sublots.
   4. Meet minimum density test average of 97 percent of maximum laboratory density with no test less than 94 percent.

C. Type II Placement – Incidental includes placement for Curb, Curb & Gutter, Driveways, Pedestrian Access Ramps, Sidewalk, Waterways, Flatwork, and other items of work in the contract to which UTBC is included and not measured or paid for separately.
   1. Use Class A or B aggregate, Table 1.
   2. The Engineer takes random samples from the grade and tests for moisture, gradation, and laboratory density, and performs In-place Density determinations.
   3. Meet gradation limits and applicable tolerances of Table 2 for each gradation test. Each sublot will be evaluated separately and not averaged with other sublots.
   4. Meet minimum density test average of 95 percent of maximum laboratory density with no test less than 92 percent.

D. Type III Placement – Shoulder
   1. Use Class A, B or C aggregate, Table 1.
   2. Adjust moisture content prior to compaction.

E. Material not meeting the gradation requirements may be allowed to remain in-place at the discretion of the Engineer, provided density requirements are met. However, additional lots may not be placed until the deficiencies are addressed and corrected.

F. Correct material that does not meet the specified criteria by scarifying, placing additional material, re-mixing, reshaping and re-compacting when directed by the Engineer. Rework unacceptable material at no additional cost to the Department.

G. Do not place additional material on any unaccepted layer.

H. Remove products found defective after placement and replace with acceptable products at no additional cost to the Department when directed by the Engineer.

PART 2 PRODUCTS

2.1 AGGREGATES

A. Well-graded, clean, hard, tough, durable and sound mineral aggregates consisting of crushed stone, crushed gravel or crushed slag; free of organic matter and contamination from chemical or petroleum products; meeting the requirements of Table 1.

Table 1

Aggregate Properties				
	Aggregate Class			
	A	B	C	
Dry Rodded Unit Weight	Not less than 75 lb/ft^3			AASHTO T 19
Liquid Limit/Plastic Index	Non-plastic		PI ≤ 6	AASHTO T 89 AASHTO 90
Aggregate Wear	Not to exceed 50 percent.			AASHTO T 96
Gradation	Table 2			AASHTO T 11 AASHTO T 27
CBR with a 10 lb surcharge measured at 0.20 inch penetration	70% Minimum		N/A	AASHTO T 193
Two Fractured Faces	50 % Min	N/A	N/A	AASHTO TP 61

B. Establish the job mix (target) gradation for the ¾ inch sieve and finer within the gradation limits. The Job Mix Gradation Tolerance is the allowable deviation from the job mix (target) gradation on the applicable sieves. All other percents passing will be within the gradation limits. Refer to AASHTO T 11 and AASHTO T 27.

Table 2

Gradation Limits		
Sieve Size	**Job Mix Gradation Target Band**	**Job Mix Gradation Tolerance**
1½ inch	100	
1 inch	90 - 100	±9.0
¾ inch	70 - 85	±9.0
½ inch	65 - 80	±9.0
⅜ inch	55 - 75	±9.0
No. 4	40 - 65	±7.0
No. 16	25 - 40	±5.0
No. 200	7 - 11	±3.0

Percent passing based on total aggregate (dry weight), and fine and coarse aggregate having approximately the same bulk specific gravities.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mixing: Provide moisture content of ± 2 percent of optimum at the time of placement. Refer to AASHTO T 180, Method D and AASHTO T 255.

B. Procedures for changing the Job-Mix Gradation
   1. Submit changes in writing 24 hours prior to placement for approval by the Engineer.

C. Placing: Place in layers of uniform thickness and compact each layer to a thickness not to exceed a 6 inch depth. Do not place on any frozen surface. Refer to Section 01572.

D. Finishing: Uniform line and grade with surface deviations no more than ⅜ inch in 10 ft in any direction.
   1. Profile Tolerance — Correct any profile deviations greater than ⅜ inch.
      a. Rework minimum of 4-inch lift to achieve homogeneous density.
      b. Determine limits of correction based on extent of deviation.
      c. Continue finishing until existing deviation is less than ⅜ inch.

E. Compaction: Maintain optimum moisture content ± 2 percent.
   1. Use appropriate compaction equipment adjacent to abutments, backwalls, approach slabs, wing walls, retaining walls, and other structures.
   2. Use a minimum of two passes with a roller for Type III placement or as directed by the Engineer.

END OF SECTION

SECTION 02741

HOT MIX ASPHALT (HMA)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for placing and compacting a surface course of one or more layers of HMA comprised of aggregate, asphalt binder, hydrated lime and other additives.

B. Option to incorporate Reclaimed Asphalt Pavement (RAP) materials into HMA pavement.

1.2 RELATED SECTIONS

A. Section 01456: Materials Dispute Resolution

B. Section 02742S: Project Specific Surfacing Requirements

C. Section 02745: Asphalt Material

D. Section 02746: Hydrated Lime

E. Section 02748: Prime Coat/Tack Coat

1.3 REFERENCES

A. AASHTO M 323: Superpave Volumetric Mix Design

B. AASHTO R 35: Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)

C. AASHTO T 19: Unit Weights and Voids in Aggregate

D. AASHTO T 89: Determining the Liquid Limit of Soils

E. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils

F. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine

G. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

H. AASHTO T 112: Clay Lumps and Friable Particles in Aggregate

I. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

J. AASHTO T 195: Determining Degree of Particle Coating of Bituminous Aggregate Mixtures

K. AASHTO T 255: Total Moisture Content of Aggregate by Drying

L. AASHTO T 304: Uncompacted Void Content of Fine Aggregate

M. AASHTO TP 61: Determining the Percentage of Fractured Particles in Coarse Aggregate

N. UDOT Materials Manual of Instruction

O. UDOT Minimum Sampling and Testing Requirements

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Submit mix design at least 10 working days before paving according to Materials Manual of Instruction 960.

B. Submit verification that hydrated lime meets the requirements of Section 02746.

C. Submit verification that asphalt binder meets the requirements of Section 02745.

D. Changes in job mix targets:
   1. Submit a written request for a change in the job-mix gradation at least 12 hours before incorporating changes into production.
      a. Include documentation supporting correlation between suggested target changes and mix design volumetric requirements. Either or both Department acceptance and Contractor QC test data are acceptable.
      b. Field volumetric mix design verification consists of three sets of two gyratory specimens run at the new target gradation or asphalt binder content or both. The Department's previous acceptance tests are acceptable for field verification.

c. The Engineer and the Region Materials Engineer provide written concurrence of the verified field volumetric mix design if it meets the volumetric requirements.

d. Submit a new laboratory volumetric mix design from a laboratory qualified by UDOT Central Materials if the field volumetric mix verification does not meet the volumetric requirements. Allow at least four working days for verification.

2. The Department allows two minor target changes per project (non-retroactive) without penalty to contractor. Minor change is defined as a maximum of two screens being adjusted with each adjustment less than or equal to 5 percent of the total job mix gradation. All other changes will require volumetric mix design verification. The Department charges $1,000 for each additional minor target change.

3. The Department performs up to two volumetric mix design verifications at no cost to the Contractor. The Department charges $3,000 for each additional laboratory or field verification required including all laboratory or field volumetric mix design verifications required due to contractor initiated target changes.

E. Submit a new laboratory volumetric mix design if changes occur in the aggregate source, asphalt binder source, or grade.

1.6 ACCEPTANCE

A. Acceptance sampling and testing of material is in according to UDOT Minimum Sampling and Testing Requirements.

B. A lot equals the number of tons of HMA placed during each production day.

C. Gradation and asphalt binder content

1. The Engineer evaluates a lot on the test results of four samples with the following exceptions:

a. Compute incentive/disincentive using the test results from three samples if only three samples can be taken for the production day.

b. Add the lot to the next day's production if three random samples cannot be taken.

c. Add the lot to the previous day's production for the final day's production if three random samples cannot be taken.

d. The lot may be increased to include up to three production days when agreed upon in advance by both the Contractor and the Engineer when less than 900 tons are anticipated per production day.

e. Evaluate with the appropriate number of tests "n" in Table 4:

2. The Engineer informs the Contractor of the time and place of sampling not more than 15 minutes before the sampling.

D. Density and Thickness

1. Contractor obtains cores within two days after the pavement is placed. Materials Manual of Instruction 984.
   a. Engineer marks coring location for in-place density and joint density cores.
   b. Move transversely to a point 1 ft from the edge of the pavement for In-place density if the random location for coring falls within 1 ft of the edge of the overall pavement section (outer part of shoulders).
   c. Fill core holes with HMA or high AC content cold mix and compact.
   d. The Department witnesses the coring operation, takes possession of the cores immediately, and begins testing the cores within 24 hours for density acceptance.
2. Density Requirements
   a. The target for in-place density including longitudinal joint density is 93.5 percent of Maximum Specific Gravity for projects where the design overlay thickness is greater than 2 inches.
   b. The target for in-place density including longitudinal joint density is 92.5 percent of Maximum Specific Gravity for projects where design overlay thickness is less than or equal to 2 inches.
   c. Use the average of the Maximum Specific Gravity tests for each lot.
   d. Acceptance for in-place density may be based on establishing a rolling pattern for bridge decks, utility work, traffic signals, detours, lane leveling, driveways, etc, or small projects with plan quantities less than 3,000 tons.
3. Thickness Requirements
   a. The Department accepts a lot for thickness when:
      1) The average thickness of all sublots is not more than ½ inch greater nor ¼ inch less than the total thickness specified.
      2) No individual sublot shows a deficient thickness of more than ⅜ inch.
   b. Excess Thickness: The Engineer may allow excess thickness to remain in place or may order its removal.
      1) The Department pays for 50 percent of the mix for material in excess of the +½ inch tolerance when excess thickness is allowed to remain in place.

c. Deficient Thickness: Place additional material where lots or sublots are deficient in thickness.
   1) The Department pays for material necessary to reach specified thickness.
   2) The Department pays for 50 percent of the mix for additional material over specified thickness necessary to achieve minimum lift thickness.
   3) Minimum compacted lift is 3 times the nominal maximum aggregate size.

d. Thickness tolerances established above do not apply to leveling courses. Check final surfaces in stage construction.

e. Thickness acceptance for thin lift projects of 2 inches or less consists of checking thickness regularly with a depth probe during placement and taking corrective action as necessary.

E. The Department applies Incentives/Disincentives for Gradation/Asphalt Content, In-Place Density, and Longitudinal Joint Density. The Engineer computes Incentive/Disincentive for each lot.

1. Compute incentive/disincentive for Gradation/Asphalt Binder and In-place Density according to Table 1.
2. Base the incentive/disincentive on Percent within Limit (PT) computation using Tables 2, 3, and 4.
3. Use lowest single value combined for gradation (each of the sieves) and asphalt binder content for calculating the gradation/asphalt binder content incentive/disincentive.
4. Use Table 4 to determine PT for in-place density.
5. Meet PT of 88 or greater for in-place density or the Department does not pay incentives on gradation/asphalt binder content.
6. Incentive for Joint Density is $0.20 per linear foot of longitudinal joint for each lift when the average of all joint densities is within the density limits of Table 2 with no single determination less than 4 percent below in-place target density.
7. The following work is not eligible for incentive.
   a. Utility work, traffic signals, detours, lane leveling, driveways, etc.
   b. Small projects with plan quantities of HMA less than 3,000 tons.
8. The Department will reject the lot if the PT is less than 60 percent.

F. The Department rejects the lot if the PT for any individual measurement is less than 60 percent.

1. The Engineer may accept a reject lot based on an Engineering analysis.
   a. A $25 per ton price reduction will be assessed.
   b. The lot will not be eligible for any incentive.

G. The Engineer may elect to accept material on visual inspection for work such as utility work, traffic signals, detours, lane leveling, driveways, etc., or small projects with plan quantities less than 3,000 tons.

1. Lots accepted on visual inspection are not eligible for Incentive/Disincentive.
2. The Engineer reserves the option of conducting any acceptance tests necessary to determine that the material and workmanship meets the project requirements.
3. Acceptance for density may be based on establishing and maintaining a roller pattern to obtain maximum density without over-stressing the pavement.

Table 1

Incentive/Disincentive for Gradation, Asphalt Binder Content, and Density	
PT Based on Min. Four Samples	**Incentive/Disincentive (Dollars/Ton)**
> 99	1.50
96-99	1.00
92-95	0.60
88-91	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject

Table 2

Upper and Lower Limit Determination	
Parameter	**UL and LL**
¾ inch sieve for 1 inch HMA ½ inch sieve for ¾ inch HMA ⅜ inch sieve for ½ inch HMA No. 4 sieve for ⅜ inch HMA	Target Value ± 6.0%
No. 8 sieve	Target Value ± 5.0%
No.50 sieve	Target Value ± 3.0%
No. 200 sieve	Target Value ± 2.0%
Asphalt Binder Content	Target Value ± 0.35%
Density	Lower Limit: Target Value - 2.0% Upper Limit: Target Value + 3.0%

Table 3

Quality Index Values for Estimating Percent Within Limits										
PU/PL	n=3	n=4	n=5	n=6	n=7	N=8	n=10	n=12	n=15	n=20
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	≤ 0.35	≤ 0.29	≤ 0.27	≤ 0.26	≤ 0.25	≤ 0.25	≤ 0.24	≤ 0.24	≤ 0.24	≤ 0.24

Enter table in the appropriate "number of tests" column and round down to the nearest value.

Table 4

Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt binder content are given in the Contractor's volumetric mix design. See this Section article 1.4 for density target values.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results–the arithmetic mean.
Sample Standard Deviations	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot Within UL and LL (PT)	PT = (PU + PL) – 100
Incentive/Disincentive	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to at least four decimal place accuracy, which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

1.7 DISPUTE RESOLUTION

A. Refer to Section 01456 when disputing the validity of the Department's acceptance tests.

PART 2 PRODUCTS

2.1 ASPHALT BINDER

A. Project Specific Surfacing Requirements. Refer to Section 02742S.

B. Asphalt Material. Refer to Section 02745.

2.2 AGGREGATE

A. Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag.

B. Refer to Table 5 to determine the suitability of the aggregate.
   1. Coarse aggregates:
      a. Retained on No. 4 sieve.
   2. Fine aggregates:
      a. Clean, hard grained, and angular.
      b. Passing the No. 4 sieve.

Table 5

Aggregate Properties – HMA			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	AASHTO TP 61	95% min.	85% min. (1 inch and ¾ inch) and 90% min. (½ inch and ⅜ inch)
Two Fractured Face	AASHTO TP 61	90% min.	80% min. (1 inch and ¾ inch) and 90% min. (½ inch and ⅜ inch)
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flakiness Index	UDOT MOI 933 (Based on ⅜ inch sieve and above)	17% max.	17% max.
L.A. Wear	AASHTO T 96	35% max.	40% max.
Sand Equivalent	AASHTO T 176 (Pre-wet method)	60 min.	45 min.
Plasticity Index	AASHTO T 89 and T 90	0	0
Unit Weight	AASHTO T 19	min. 75 lb/cu ft	min. 75 lb/cu ft
Soundness (sodium sulfate)	AASHTO T 104	16% max. loss with five cycles	16% max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2% max	2% max.
Natural Fines	N/A	0%	10% max.
Category 1: National Highway System and Truck Routes - Table 9. Category 2: All Other Routes			

C. Meet gradation requirements in Table 6.

Table 6

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)					
Sieve Size		1 inch	¾ inch	½ inch	⅜ inch
Control Sieves	1½ inch	100.0			
	1 inch	90.0 - 100.0	100.0		
	¾ inch	<90	90.0 - 100.0	100.0	
	½ inch		<90	90.0 – 100.0	100.0
	⅜ inch			<90	90.0 - 100.0
	No. 4				< 90
	No. 8	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0
	No. 200	1.0 - 7.0	2.0 - 8.0	2.0 – 10.0	2.0 – 10.0

2.3 HYDRATED LIME

A. Meet the requirements of Section 02746.

2.4 RECLAIMED ASPHALT PAVEMENT (OPTIONAL)

A. No asphalt binder grade adjustment is necessary when reclaimed asphalt pavement (RAP) is limited to 15 percent by total weight of the hot mix.

B. Adjust asphalt binder grade according to AASHTO M 323 when RAP content is between 15 to 25 percent of the total weight of the hot mix.
   1. Select one grade softer than the grade specified. Do not select any grades lower than PG XX-34.

C. Adjust asphalt binder grade according to AASHTO M 323 Appendix A when RAP content exceeds 25 percent.
   1. Obtain Engineers approval to exceed 25 percent.
   2. Use RAP from a single source.
   3. Provide test reports indicating that the PG grade of the recovered asphalt binder is consistent throughout the stockpile.
   4. Limit RAP to 30 percent of the total weight of the hot mix.

D. RAP aggregate is required to meet Table 5 with exception of Sand Equivalent AASHTO T 176.

2.5 VOLUMETRIC DESIGN

A. Perform Superpave Volumetric Mix Design according to UDOT Materials Manual of Instruction 960 and the following:
   1. Incorporate hydrated lime into all designs. Refer to Section 02746.
   2. Comply with Table 7 and Table 8.

B. The Department Region Materials Lab verifies the Volumetric Mix Design. UDOT Materials Manual of Instruction 960
   1. Do not begin paving until verification is complete.

Table 7

Volumetric Design Gyrations				
20 Years Design ESALS (Million)	Compaction Parameters			Voids Filled with Asphalt (VFA) (%)
	$N_{initial}$ /% of G_{mm}*	N_{design} /% of G_{mm}*	N_{max} /% of G_{mm}*	
0.3	6/≤ 91.5	50/ 96.5	75/≤ 98	70 - 80 **
0.3 to <3	7/≤ 90.5	75/ 96.5	115/≤ 98	70 - 80
3 to < 30	8/≤ 89	100/ 96.5	160/≤ 98	70 - 80
≥ 30	9/≤ 89	125/ 96.5	205/≤ 98	70 - 80

* G_{mm}: Maximum specific gravity of mix. (Rice Method)
** 67 percent specified lower limit VFA for 1-inch nominal maximum size mixture.

Table 8

Volumetric Design Requirements	
HMA design mixing and compaction temperatures	Provided by the Engineer
Dust Proportion Range	0.6 - 1.40
Voids in Mineral Aggregate (VMA) at N_{design} AASHTO R 35.9.2 using G_{sb} at SSD. Equation based on percent of total mix.	12.5 % - 13.5 % for 1 inch 13.5 % - 14.5 % for ¾ inch 14.5 % - 15.5 % for ½ inch 15.5 % - 16.5 % for ⅜ inch
Hamburg Wheel Tracker UDOT MOI 990	Category 1 Roads: Maximum 10 mm impression at 20,000 passes. Category 2 Roads: Maximum 10 mm impression at 10,000 passes

PART 3 EXECUTION

3.1 HMA

A. Dry aggregate to an average moisture content of not more than 0.2 percent by weight.
   1. May be verified by AASHTO T 255.
   2. Adjust burners to avoid damage or soot contamination of the aggregate.

B. Treat aggregate with hydrated lime. Refer to Section 02746.
   1. Insure lime slurry equipment is operating at all times when using Method A.
      a. Cease production if hydrated lime slurry treatment is interrupted.
      b. Engineer may require marination of the aggregate/hydrated lime mixture in the stockpile, Method B, if production continues without hydrated lime slurry treatment.

C. Coat with asphalt binder 100 percent of the particles passing and 98 percent of the particles retained on the No. 4 sieve.
   1. May be verified by AASHTO T 195.
   2. Discontinue operation and make necessary corrections if material is not properly coated.

D. Maintain temperature of the HMA between identified limits for mixing and compaction as defined on Volumetric Mix Design Verification Letter.
   1. Department rejects materials heated over the identified limits.
   2. Remove all material rejected by the Department for overheating.

3.2 HMA PLANT

A. Provide:
   1. Positive means to determine the moisture content of aggregate.
   2. Positive means to sample all material components.
   3. Sensors to measure the temperature of the HMA at discharge.
   4. The ability to maintain mix discharge temperature according to the mix design.

B. Provide asphalt binder storage tanks that:
   1. Calibrate tanks so the quantity of material remaining in the tank can be determined at any time.
   2. Provide a positive means of sampling the asphalt binder from the tanks.

3.3 CEASE PRODUCTION

A. Cease production when any two out of three consecutive lots meet one of the following criteria:
   1. A net disincentive
   2. Air voids at N_{des} averaged for each lot are less than 2.5 or greater than 4.5 percent
   3. VMA at N_{des} averaged for each lot are not within Target Value ± 1.25 percent

B. Submit a corrective action plan to the Engineer before production continues indicating the changes in production procedures that will be implemented to correct the deficiencies.

3.4 CONTRACTOR INITIATED CHANGES IN MIX DESIGN

A. Changes in job mix gradation:
   1. Submit a written request for a change in a job-mix gradation. Refer to this Section, article 1.5.

3.5 LABORATORY CORRELATION

A. Perform split-sample, paired *t*-testing with the Department based on project quality control testing using UDOT LQP qualified lab.
   1. Perform split-sample, paired *t* analysis on all mix acceptance tests and tests related to volumetric properties.
   2. Perform paired *t* analysis as defined in the Materials Manual of Instruction, Appendix C.
   3. Continue paired *t*-testing until at least two consecutive production days meet $\alpha = 0.05$ for a two tailed distribution.

3.6 SURFACE PREPARATION

A. Locate, reference, and protect all utility covers, monuments, curb and gutter and other components affected by the paving operations.

B. Remove all moisture, dirt, sand, leaves, and other objectionable material from the prepared surface before placing the mix.

C. Complete spot leveling before placing pavement courses.
   1. Place, spread, and compact leveling mix on portions of the existing surface.
   2. Fill and compact any localized potholes more than 1 inch deep.
   3. Allow compacted mix to cool sufficiently to below 150 degrees F to provide a stable structural platform before placing additional lifts of HMA.

D. Allow sufficient cure time for prime coat/tack coat before placing HMA. Refer to Section 02748.

3.7 SURFACE PLACEMENT

A. Provide a 3:1 (horizontal to vertical) sloped edge adjacent to the next lane to be paved when full-width or Echelon paving is impractical and more than one pass is required.

B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.

C. Offset longitudinal joints 6 to 12 inches in succeeding courses.
   1. Place top course joint within 1 ft of the centerline or lane line.
   2. Tack the longitudinal edge before placing the adjacent pass if the previous pass has cooled below 175 degrees F.

D. Offset transverse construction joints at least 6 ft longitudinally.

E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.

F. Taper the end of a course subjected to traffic at approximately 50:1 (horizontal to vertical).
   1. Remove the portion of the pass that contains the tapered end before placing fresh mix.
   2. Tack the contact surfaces before fresh mix is placed against the compacted mix.

G. Use a motor grader, spreader box, or other approved spreading methods for projects under 180 yd^2, irregular areas, or for miscellaneous construction such as detours, sidewalks, and leveling courses.

3.8 COMPACTION

A. Use a small compactor or vibratory roller at structures in addition to normal rolling.

B. Operate in a transverse direction next to the back wall and approach slab.

3.9 LIMITATIONS

A. Do not place on frozen base or during adverse climatic conditions such as precipitation or when roadway surface is icy or wet.

B. Use a release agent acceptable to the Engineer for all equipment and hand tools used to mix, haul, and place the HMA.

C. Place between April 15, and October 15, and when the air temperature in the shade and the roadway surface temperature are above 50 degrees F.
   1. The Department determines and provides written approval if it is acceptable to place outside the above limits.

Table 9

Category 1 Roads		
Route	**Beginning**	**Ending**
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 – Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I -15 - North Salt Lake
US-6	Nevada State Line	Jct US-50 – Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US-40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 – Holden
US-89	Arizona State Line	Jct I-70 – Sevier
US-89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 – Lehi
US-89	SR-71 - Draper	Jct SR-269 - 5th and 6th South
US-89	Jct I-15 - North Salt Lake	Junction I-15 Bountiful
US-89	Jct I-15 Farmington	Jct I-84 – Uintah
US-89	Jct I-84 - Uintah	Jct US-91 Brigham City
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Idaho State Line
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-491	Jct US-191 - Monticello	Colorado State Line
SR-9 - Zions Park	Junction I-15	Jct US-80 - Mt. Carmel Jct
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 – Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-13- Box Elder Co	Jct US-91 Brigham City	Jct SR-83 - Corrine
SR-26 – Riverdale Road	Jct 126-Roy	Jct US-89 – Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-30 – Box Elder/Cache Co	Jct I-15 - Riverside	Jct US-89 Logan
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 12 th Street Ogden	Mile Post 0	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct 1-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance – Wilberg Coal Mine
SR-67 - Legacy Highway	Jct I-215	Jct. I-15
SR-71 - 7th and 9th East Street, Salt Lake City	Jct SR-209 - 90th South Street	Jct SR-186 - 4th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi

Category 1 Roads		
Route	**Beginning**	**Ending**
SR-79 – 30th and 31st Street Ogden	Jct SR-126	Jct SR-203 - Harrison Blvd.
SR-83- Thiokol Road	Jct SR-13- Corrine	MP 25 Lampo Junction
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-101- Cache Co.	Jct US-91 Wellsville	Jct SR-65 – Hyrum
SR-108 – Antelope Drive/ Midland Drive	Jct I-15 Mile Post 0	Jct 126 - West Haven
SR-104 20th 21st Street Ogden	Jct SR-126	Jct SR-204
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21st South Expressway
SR-126 1900 West	Jct SR-108 Layton	Jct US-89 - So Willard.
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 – Draper	Jct I-80 - Salt Lake Intl Airport
SR-165 Cache Co.	Jct SR-101 – Hyrum	Jct US-91 – Logan
SR-171 - 33rd and 35th South, Salt Lake City	Jct SR-172 - 56th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street Salt Lake City	Jct 6200 South – Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood
SR-193 – East Hill Field Road	Jct SR-126 – Clearfield	Jct US-89 – Layton
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12th Street
SR-204- Wall Ave	Jct SR-26 – Riverdale Road	Jct US-89 - Harrisville
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90th and 96th South
SR-232- Hill Field Road	Jct SR-126 – Layton	Hill Air Force Base
SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 - East, Exit 5
SR-266 - 45th & 47th South Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South Salt Lake City	Jct I-215, Exit 310	Jct SR-71- 7th East Street

END OF SECTION

SECTION 02745

ASPHALT MATERIAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt materials

1.2 RELATED SECTIONS Not Used

1.3 REFERENCES

A. AASHTO M 81: Cut-Back Asphalt (Rapid-Curing Type)

B. AASHTO M 82: Cut-Back Asphalt (Medium-Curing Type)

C. AASHTO M 140: Emulsified Asphalt

D. AASHTO M 208: Cationic Emulsified Asphalt

E. AASHTO M 226: Viscosity Graded Asphalt Cement

F. AASHTO M 320: Performance Graded Asphalt Cement

G. AASHTO R 28: Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)

H. AASHTO T 44: Solubility of Bituminous Materials

I. AASHTO T 48: Flash and Fire Points by Cleveland Open Cup

J. AASHTO T 49: Penetration of Bituminous Materials

K. AASHTO T 50: Float Test for Bituminous Materials

L. AASHTO T 51: Ductility of Bituminous Materials

M. AASHTO T 59: Testing Emulsified Asphalt

N. AASHTO T 201: Kinematic Viscosity of Asphalts

O. AASHTO T 228: Specific Gravity of Semi-Solid Bituminous Materials

P. AASHTO T 240: Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)

Q. AASHTO T 300: Force Ductility of Bituminous Materials

R. AASHTO T 301: Elastic Recovery Test of Bituminous Materials by Means of a Ductilometer

S. AASHTO T 313: Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)

T. AASHTO T 314: Determining the Fracture Properties of Asphalt Binder in Direct Tension

U. AASHTO T 315: Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

V. AASHTO T 316: Viscosity Determination of Asphalt Binder Using Rotational Viscometer

W. ASTM D 92: Flash and Fire Points by Cleveland Open Cup

X. ASTM D 1190: Concrete Joint Sealer, Hot-Applied Elastic Type

Y. ASTM D 2006: Method of Test for Characteristic Groups in Rubber Extender and Processing Oils by the Precipitation Method.

Z. ASTM D 2007: Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method

AA. ASTM D 2026: Cutback Asphalt (Slow-Curing Type)

BB. ASTM D 3405: Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

CC. ASTM D 4402: Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus

DD. ASTM D 5329: Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements

EE. ASTM D 5801: Toughness and Tenacity of Bituminous Materials

FF. California Test Methods

GG. UDOT Materials Manual of Instruction

HH. UDOT Minimum Sampling and Testing Guide

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Supply a vendor-prepared bill of lading showing the following information for each material shipment:
   1. Type and grade of material
   2. Type and amount of additives used, if applicable
   3. Destination
   4. Consignee's name
   5. Date of Shipment
   6. Railroad car or truck identification
   7. Project number
   8. Loading temperature
   9. Net weight in tons or net gallons corrected to 60 degrees F, when requested
   10. Specific gravity
   11. Bill of lading number
   12. Manufacturer of asphalt material

1.6 DELIVERY, STORAGE, AND HANDLING

A. Each shipment of asphalt material must:
   1. Be uniform in appearance and consistency.
   2. Show no foaming when heated to the specified loading temperature.

B. Do not supply shipments contaminated with other asphalt types or grades than those specified.

1.7 GRADE OF MATERIAL

A. The Engineer determines the grade of material to be used based on the supply source designated by the Contractor when the bid proposal lists more than one grade of asphalt material.

1.8 PAYMENT PROCEDURES

A. Price adjustments for asphalt cement and liquid asphalt including chip-seal emulsions and cut-backs:
   1. Standard department procedures governs price adjustments made where asphalt material does not conform to the specifications
      a. The Engineer may order the removal of any or all the defective asphalt material if the price adjustment exceeds 30 percent.
      b. The pay factor for such material is 0.50 when allowed to remain in place.

B. Price adjustments for Performance Graded Asphalt Binder (PGAB):
   1. Standard department PGAB management plan governs price reductions or removal of material where the binder does not conform to the specifications.

PART 2 PRODUCTS

2.1 PERFORMANCE GRADED ASPHALT BINDER (PGAB)

A. Supply PGABs under the Approved Supplier Certification (ASC) System. Refer to the UDOT Minimum Sampling and Testing Guide, Section 509, Asphalt Binder Management Plan.

B. Refer to AASHTO M 320 for all PGABs having algebraic differences less than 92 degrees between the high and low design temperatures.

C. Refer to Tables 1, 2, 3, 4, 5, 6, 7, and 8 for all PGABs having algebraic differences equal to or greater than 92 degrees between the high and low design temperatures.

Table 1

PG58-34		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@58°C, G*, kPa	1.30 Min.
	@58°C, phase angle, degrees	74.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@58°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	65 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@16°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-24°C, S, MPa	300 Max.
	@-24°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-24°C, Failure Strain, %	1.5 Min.
	@-24°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...		
(b) No allowances will be given for passing at a colder grade.		

Table 2

PG64-28		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@64°C, G*, kPa	1.30 Min.
	@64°C, phase angle, degrees	74.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@64°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	65 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@22°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-18°C, S, MPa	300 Max.
	@-18°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-18°C, Failure Strain, %	1.5 Min.
	@-18°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...		
(b) No allowances will be given for passing at a colder grade.		

Table 3

PG64-34		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@64°C, G*, kPa	1.30 Min.
	@64°C, phase angle, degrees	71.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T-240		
Dynamic Shear Rheometer, AASHTO T 315	@64°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	70 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@19°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-24°C, S, MPa	300 Max.
	@-24°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-24°C, Failure Strain, %	1.5 Min.
	@-24°C, Failure Stress (b), MPa	4.0 Min.

(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...
(b) No allowances will be given for passing at a colder grade.

Table 4

PG70-22		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*, kPa	1.30 Min.
	@70°C, phase angle, degrees	74.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	65 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@28°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-12°C, S, MPa	300 Max.
	@-12°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-12°C, Failure Strain, %	1.5 Min.
	@-12°C, Failure Stress (b), MPa	4.0 Min.

(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...
(b) No allowances will be given for passing at a colder grade.

Table 5

PG70-28		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*, kPa	1.30 Min.
	@70°C, phase angle, degrees	71.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	70 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@25°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-18°C, S, MPa	300 Max.
	@-18°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-18°C, Failure Strain, %	1.5 Min.
	@-18°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...		
(b) No allowances will be given for passing at a colder grade.		

Table 6

PG70-34		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*, kPa	1.30 Min.
	@70°C, phase angle, degrees	71.0 Max.
Rotational Viscometer, AASHTO T 316	@135 °C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@70°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	75 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@22°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-24°C, S, MPa	300 Max.
	@-24°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-24°C, Failure Strain, %	1.5 Min.
	@-24°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors.		
(b) No allowances will be given for passing at a colder grade.		

Table 7

PG76-22		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@76°C, G*, kPa	1.30 Min.
	@76°C, phase angle, degrees	71.0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@76°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	70 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@ 31°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-12°C, S, MPa	300 Max.
	@-12°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-12°C, Failure Strain, %	1.5 Min.
	@-12°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...		
(b) No allowances will be given for passing at a colder grade.		

Table 8

PG76-28		
Original Binder		
Dynamic Shear Rheometer, AASHTO T 315	@76°C, G*, kPa	1.30 Min.
	@76°C, phase angle, degrees	71. 0 Max.
Rotational Viscometer, AASHTO T 316	@135°C, Pa.s	3 Max.
Flash Point, AASHTO T 48	°C	260 Min.
RTFO Residue, AASHTO T 240		
Dynamic Shear Rheometer, AASHTO T 315	@76°C, G*/sinδ, kPa	2.20 Min.
Elastic Recovery, AASHTO T 301 mod (a)	%	75 Min.
PAV Residue, 20 hours, 2.10 MPa, 100 °C, AASHTO R 28		
Dynamic Shear Rheometer, AASHTO T 315	@28°C, kPa	5000 Max.
Bending Beam Rheometer, AASHTO T 313	@-18°C, S, MPa	300 Max.
	@-18°C, m-value	0.300 Min.
Direct Tension Test, AASHTO T 314	@-18°C, Failure Strain, %	1.5 Min.
	@-18°C, Failure Stress (b), MPa	4.0 Min.
(a) Modify paragraph 4.5 as follows: Stop the ductilometer after 20 cm has been reached and within 2 seconds. Sever the specimen at its center with a pair of scissors...		
(b) No allowances will be given for passing at a colder grade.		

2.2 ASPHALTIC CEMENT, LIQUID ASPHALTS, AND REJUVENATING AGENTS

A. Refer to AASHTO M 226, Table 2 with the following modifications:
   1. Delete and replace ductility at 77 degrees F (25 degrees C) with ductility at 39.2 degrees F (4 degrees C) with values as detailed below.

AC - 2.5	AC - 5	AC - 10	AC - 20
50+	25+	15+	5+

B. As specified for cationic and anionic emulsified asphalt.
   1. All standard Slow Setting (SS, CSS), Medium Setting (MS, CMS), and Rapid Setting (RS, CRS) grades; inclusive of all High-Float designations (HF).
   2. Supply under the Approved Supplier Certification System (ASC).
   3. Meet AASHTO M 208 and M 140.

C. Conform to the requirements of one of these tables:
   1. Table 9: Cationic Rapid Setting Emulsified Polymerized Asphalt (CRS-2P)
   2. Table 10: Latex Modified Cationic Rapid Setting Emulsified Asphalt (LMCRS-2)
   3. Table 11: Cationic Medium Setting Emulsified Asphalt (CMS-2S)
   4. Table 12: High Float Medium Setting Emulsified Asphalt (HFMS-2)
   5. Table 13: High Float Medium Setting Emulsified Polymerized Asphalt (HFMS-2P)
   6. Table 14: High Float Medium Setting Emulsified Polymerized Asphalt (HFMS-2SP)
   7. Table 15: High Float Rapid Setting Emulsified Polymerized Asphalt (HFRS-2P).
   8. Table 16: Setting Cationic Rapid Emulsified Asphalt (CRS-2A, B)

D. Curing cut-back asphalt:
   1. Refer to ASTM D 2026 as specified for slow curing (SC).
   2. Refer to AASHTO M 82 as specified for medium curing (MC).
   3. Refer to AASHTO M 81 as specified for rapid curing (RC).

E. Conform to requirements for Emulsified Asphalt Pavement Rejuvenating Agent:
   1. Table 17: Type A
   2. Table 18: Type B
   3. Table 19: Type B Modified
   4. Table 20: Type C
   5. Table 21: Type D

Table 9

Cationic Rapid Setting Emulsified Polymerized Asphalt (CRS-2P)			
Tests	**AASHTO Test Method**	**Min.**	**Max.**
Emulsion			
Viscosity , SF, 140ºF (60ºC), s (Project-site Acceptance/Rejection Limits)	T59	100	400
Settlement (a) 5 days, percent	T 59		5
Storage Stability Test (b) 1 d, 24 h, percent	T 59		
Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, percent	T 59	40	
Particle Charge Test	T 59	Positive	
Sieve Test, percent	T 59		0.10
Distillation			
Oil distillate, by volume of emulsion, percent			0
Residue (d), percent		68	
Residue from Distillation Test			
Penetration, 77ºF (25ºC), 100 g, 5 s, dmm	T 49	80	150
Ductility, 39.2ºF (4ºC), 5 cm/min, cm Toughness, lb-in Tenacity, lb-in	T 51 ASTM D 5801 ASTM D 5801	35 75 50	
Solubility in trichloroethylene, percent	T 44	97.5	

The test requirement for settlement may be waived when the emulsified asphalt is used in less than five-days or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.

(b) The 24-hour (1-day) storage stability test may be used instead of the five-day settlement test.

(c) The demulsibility test is made within 30 days from date of shipment.

(d) Distillation is determined by AASHTO T 59, with modifications to include a 350 ± 5ºF (177±3ºC) maximum temperature to be held for 15 minutes.

Modify the asphalt cement prior to emulsification.

Table 10

Latex Modified Cationic Rapid Setting Emulsified Asphalt (LMCRS-2)			
Tests	**AASHTO Test Method**	**Min.**	**Max.**
Emulsion			
Viscosity, SF, 122ºF (50ºC), s (Project Site Acceptance/Rejection Limits)	T59	140	400
Settlement (a) 5 days, percent	T 59		5
Storage Stability Test (b) 1 d, 24 h, percent	T 59		1
Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, percent	T 59	40	
Particle Charge Test	T 59	Positive	
Sieve Test, percent	T 59		0.3
Distillation			
Oil distillate, by volume of emulsion, percent			0
Residue (d), percent		65	
Residue from Distillation Test			
Penetration, 77ºF (25ºC), 100 g, 5 s, dmm	T 49	40	200
Torsional Recovery (e)		18	

(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
(b) May use the 24-hour (1-day) storage stability test instead of the five-day settlement test.
(c) Make the demulsibility test within 30 days from date of shipment.
(d) Determine distillation by AASHTO T 59, with modifications to include a 350 ± 5ºF (177±3ºC) maximum temperature to be held for 15 minutes.
(e) CA 332 (California Test Method)

Co-mill latex and asphalt during emulsification

Table 11

Cationic Medium Setting Emulsified Asphalt (CMS-2S)		
Tests	**AASHTO Test Method**	**Specification**
Emulsion		
Viscosity, SF, 122ºF (50ºC), s	T 59	50 - 450
Percent residue	T 59	60 min
Storage Stability Test, 1d, 24h, percent	T 59	1 max
Sieve, percent	T 59	0.10 max
Particle charge	T 59	Positive
Oil Distillate, percent by volume of emulsion	T 59	5-15
Residue		
Penetration, 77ºF (25ºC), 100g, 5 sec, dmm	T 59	100-250
Solubility, percent	T 59	97.5 min.

Table 12

High Float Medium Setting Emulsified Asphalt (HFMS-2)			
Tests	**AASHTO Test Method**	**Min.**	**Max.**
Emulsion			
Viscosity, SF, 122°F (50°C), s (Project Site Acceptance/Rejection Limits	T59	70	300
Storage Stability Test, 1d, 24 h, percent	T59		1.0
Sieve Test , percent	T59		0.1
Distillation	T59		
Oil Distillate, by volume of emulsion, percent	T59	NA	NA
Residue, percent	T59	65	
Residue from Distillation Test			
Penetration, 77°F (25°C), 100g, 5 s, dmm	T49	50	200
Float Test, 140°F (60°C), s	T50	1200	
Solubility in Trichloroethylene, percent	T44	97.5	
Ductility, 77°F (25°C) 5cm/min, cm	T51	40	

Table 13

High Float Medium Setting Emulsified Polymerized Asphalt (HFMS-2P) (a)			
Tests	**AASHTO Test method**	**Min.**	**Max.**
Emulsion			
Viscosity, SF, 122ºF (50ºC), s (Project Site Acceptance/Rejection Limits)	T 59	100	450
Storage Stability Test, 1 d, 24 h, percent	T 59		1.0
Sieve Test, percent	T 59		0.1
Distillation			
Oil distillate, by volume of emulsion, percent	T 59		7
Residue (b), percent	T 59	65	
Residue from Distillation Test			
Penetration, 77ºF (25ºC), 100 g, 5 s, dmm	T 49	70	300
Float Test, 140ºF (60ºC), s	T 50	1200	
Solubility in trichloroethylene, percent	T 44	97.5	
Elastic Recovery, 77ºF (25ºC), percent	T 301	50	

(a) Supply an HFMS-2P (anionic, polymerized, high-float) as an emulsified blend of polymerized asphalt cement, water, and emulsifiers. Polymerize the asphalt cement with a minimum of 3.0% polymer by weight of the asphalt cement prior to emulsification. The emulsion must be smooth and homogeneous throughout with no white, milky separation, pumpable, and suitable for application through a distributor after standing undisturbed for a minimum of 24 hours.

(b) Determine the distillation by AASHTO T 59, with modifications to include a 350± 5ºF (177±3ºC) maximum temperature to be held for 15 minutes.

Table 14

High Float Medium Setting Emulsified Polymerized Asphalt (HFMS-2SP) (a)			
Tests	**AASHTO Test method**	**Min.**	**Max.**
Emulsion			
Viscosity, SF, 122ºF (50ºC), s (Project Site Acceptance/Rejection Limits)	T 59	50	450
Storage Stability Test, 1 d, 24 h, percent	T 59		1
Sieve Test, percent	T 59		0.1
Distillation			
Oil distillate, by volume of emulsion, percent	T 59		7
Residue (b), percent	T 59	65	
Residue from Distillation Test			
Penetration, 77ºF (25ºC), 100 g, 5 s, dmm	T 49	150	300(c)
Float Test, 140ºF (60ºC), s	T 50	1200	
Solubility in trichloroethylene, percent	T 44	97.5	
Elastic Recovery(d), 77ºF (25ºC), percent	T 301	50	

(a) Supply an HFMS-2SP (anionic, polymerized, high-float) as an emulsified blend of polymerized asphalt cement, water, and emulsifiers. Polymerize the asphalt cement with a minimum of 3.0% polymer by weight of the asphalt cement prior to emulsification. The emulsion must be smooth and homogeneous throughout with no white, milky separation, pumpable, and suitable for application through a distributor after standing undisturbed for a minimum of 24 hours.

(b) Determine the distillation by AASHTO T 59, with modifications to include a 350± 5ºF (177±3ºC) maximum temperature to be held for 15 minutes.

(c) Emulsified Asphalt (HFMS-2SP) with a residual penetration greater than 300 dmm may be used with Cold Bituminous Pavement (Recycle) to address problems with cool weather or extremely aged existing pavement when approved by the Engineer.

(d) Report only when penetration is greater than 300 dmm.

Table 15

High Float Rapid Setting Emulsified Polymerized Asphalt (HFRS-2P) (a)			
Tests	**AASHTO Test method**	**Min.**	**Max.**
Emulsion			
Viscosity, SF @ 122ºF (50ºC), s (Project Site Acceptance/Rejection Limits)	T 59	50	450
Storage Stability Test (b) 1 d, 24 h, percent	T 59		1
Demulsibility 0.02 N Ca Cl_2, percent	T 59	40	
Sieve Test, percent	T 59		0.1
Distillation			
Oil distillate, by volume of emulsion, percent	T 59		3
Residue (b), percent	T 59	65	
Residue from Distillation Test			
Penetration, 77ºF (25ºC), 100 g, 5 s, dmm	T 49	70	150
Float Test, 140ºF (60ºC), s	T 50	1200	
Solubility in trichloroethylene, percent	T 44	97.5	
Elastic Recovery, 77ºF (25ºC), percent	T 301	58	

(a) Supply an HFMS-2SP (anionic, polymerized, high-float) as an emulsified blend of polymerized asphalt cement, water, and emulsifiers. Polymerize the asphalt cement with a minimum of 3.0% polymer by weight of the asphalt cement prior to emulsification. The emulsion must be smooth and homogeneous throughout with no white, milky separation, pumpable, and suitable for application through a distributor after standing undisturbed for a minimum of 24 hours.

(b) Determine the distillation by AASHTO T 59, with modifications to include a 350 ± 5ºF (177±3ºC) maximum temperature to be held for 15 minutes.

Table 16

Cationic Rapid Setting Emulsified Asphalt (CRS-2A,B)			
Tests	**AASHTO Test Method**	**Min**	**Max**
Emulsion			
Viscosity, SF, 122ºF (50ºC), s (Project Site Rejection/Acceptance Limits)	T 59	140	400
Storage stability test, 24 h, percent	T 59		1
Demulsibility, 35 mL 0.8 percent Sodium Dioctyl Sulfosucinate, percent	T 59	40	
Particle charge test	T 59	Positive	
Sieve test, percent	T 59		0.10
Distillation			
Oil distillate, by volume of emulsion, percent	T 59		0
Residue, percent	T 59	65	
Use PG58-22 and PG64-22 as base asphalt cement for CRS-2A, B, respectively. Specification for high temperature performance: original and RTFO G*/sinδ within 3ºC of grade.			

Table 17

Emulsified Type A Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SF, 77ºF (25ºC), s	AASHTO T 59	15 Min 40 Max
Residue , percent W (a)	AASHTO T 59	60 Min. 65 Max.
Miscibility Test (b)	AASHTO T 59	No Coagulation
Sieve Test, percent W (c)	AASHTO T 59	0.20 Max.
5-day Settlement, percent W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Light Transmittance , %	UDOT MOI 8-973	30 Max.
Cement Mixing	AASHTO T 59	2 Max.
Residue from Distillation (a)		
Viscosity, 140ºF (60ºC), mm^2/s	ASTM D 4402	150 - 300
Flash Point, COC, ºF (ºC)	AASHTO T 48	385 Min.
Asphaltenes, percent W	ASTM D 2006-70	0.4 Min. 0.75 Max.
Maltene Distribution Ratio $(PC + A_1)/(S + A_2)$ (d)	ASTM D 2006-70	0.3 Min. 0.6 Max
Saturated Hydrocarbons, S (d)	ASTM D 2006-70	21 Min. 28 Max.
PC/S Ratio (d)	ASTM D 2006-70	1.5 Min.

(a) AASHTO T 59, Evaporation Test, modified as follows: Heat a 50 gram sample to 300ºF until foaming ceases, then cool immediately and calculate results.

(b) AASHTO T 59, modified as follows: use a 0.02 Normal Calcium Chloride solution in place of distilled water.

(c) AASHTO T 59, modified as follows: use distilled water in place of a two percent sodium oleate solution.

(d) Chemical composition by ASTM Method D-2006-70:
PC= Polar Compounds, A_1 = First Acidaffins
A_2 = Second Acidaffins, S = Saturated Hydrocarbons

Table 18

Emulsified Type B Asphalt Pavement Rejuvenating Agent Concentrate		
Tests	**Test Method**	**Limits**
Viscosity, SF, 77ºF (25ºC), s	AASHTO T 59	25-150
Residue, percent W	AASHTO T 59 (mod) (a)	62 Min.
Sieve Test, percent W	AASHTO T 59	0.10 Max.
5-day Settlement	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Residue from Distillation (a)		
Viscosity @ 140ºF (60ºC), mm^2/s	AASHTO T 201	2500-7500
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	98 Min.
Flash Point, COC	ASTM D 92	204ºC, Min.
Asphaltenes, percent W	ASTM D 2007	15 Max.
Saturates, percent W	ASTM D 2007	30 Max.
Aromatics, percent W	ASTM D 2007	25 Min.
Polar Compounds, percent W	ASTM D 2007	25 Min.

(a) Determine the distillation by AASHTO T 59 with modifications to include a 300 ±5ºF (149±3ºC) maximum temperature to be held for 15 minutes.

(b) Test pumping stability by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 77ºF (25ºC) through a ¼ inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.

Type B: an emulsified blend of lube oil or lube oil extract and petroleum asphalt.

Table 19

Emulsified Type B Modified Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SF, 77ºF (25ºC), s	AASHTO T 59	50-200
Residue(a), percent W	AASHTO T 59	62 Min.
Sieve Test, percent W	AASHTO T 59	0.20 Max.
5-day Settlement, percent W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Residue from Distillation (a)		
Viscosity (c) 275ºF (135ºC), cP	ASTM D 4402	150 – 300
Penetration, 77ºF (25ºC), dmm	AASHTO T 49	180 Min.
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	98 Min.
Flash Point, COC, ºF (ºC)	AASHTO T 48	400(204) Min.
Asphaltenes, percent W	ASTM D 2007	20-40
Saturates, percent % W	ASTM D 2007	20 Max.
Polar Compounds, percent W	ASTM D 2007	25 Min.
Aromatics, percent W	ASTM D 2007	20 Min.
PC/S Ratio	ASTM D 2007	1.5 Min.

(a) Determine the distillation by AASHTO T 59 with modifications to include a 300±5ºF (149± 3ºC) maximum temperature to be held for 15 minutes.

(b) Pumping stability is tested by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 77ºF (25ºC) through a ¼ inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.

(c) Brookfield Thermocel Apparatus-LV model. ≥ 50 rpm with a #21 spindle, 7.1 g residue, at > 10 torque

As required by the Asphalt Emulsion Quality Management Plan, UDOT Minimum Sampling and Testing Guide, Section 508) the supplier certifies that the base stock contains a minimum of 15% by weight of Gilsonite Ore. Use the HCL precipitation method as a qualitative test to detect the presence of Gilsonite.

Table 20

Emulsified Type C Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SF, 77ºF (25ºC), s	AASHTO T 59	10-100
Residue (a), percent W (Type C supplied ready to use 1:1 or 2:1.	AASHTO T 59	30 Min. 1:1 40 Min. 2:1
Sieve Test, percent W (b)		0.10 Max.
5-day Settlement, percent W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
pH (May be used if particle charge test is inconclusive)		2.0 - 7.0
Pumping Stability (c)		Pass
Tests of Residue from Distillation (a)		
Viscosity, 275ºF (135ºC), mm^2/s	AASHTO T 201	475-1500
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	97.5 Min.
RTFO mass loss, percent W	AASHTO T 240	2.5 Max.
Specific Gravity	AASHTO T 228	0.98 Min.
Flash Point, COC	AASHTO T 48	232ºC, Min.
Asphaltenes, percent W	ASTM D 2007	25 Min., 45 Max.
Saturates, percent W	ASTM D 2007	10 Max.
Polar Compounds, percent W	ASTM D 2007	30 Min.
Aromatics, percent W	ASTM D 2007	15 Min.
(a) Determine the distillation by AASHTO T 59 with modifications to include a 300± 5ºF (149 ± 3ºC) maximum temperature to be held for 15 minutes. (b) Test method identical to AASHTO T 59 except that distilled water is used in place of 2 % sodium oleate solution. (c) Test pumping stability by pumping 475 ml of Type diluted 1 part concentrate to 1 part water, at 77ºF (25ºC) through a ¼ inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.		
As required by the Asphalt Emulsion Quality Management Plan, UDOT Minimum Sampling and Testing Guide, Section 508), the supplier certifies that the base stock contains a minimum of 10% by weight of Gilsonite ore. Use the HCL precipitation method as a qualitative test to detect the presence of Gilsonite.		

Table 21

Emulsified Type D Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SF, 77ºF (25ºC), s	AASHTO T 59	30-90
Residue, (b) percent W	AASHTO T 59	65
Sieve Test, percent W	AASHTO T 59	0.10 Max.
pH		2.0 - 5.0
Residue from Distillation (b)		
Viscosity, 140ºF (60ºC), cm^2/s	AASHTO T 201	300-1200
Viscosity, 275ºF (135ºC), mm^2/s	AASHTO T 201	300 Min.
Modified Torsional Recovery (a) percent	CA 332 (Mod)	40 Min.
Toughness, 77ºF (25ºC), in-lb	ASTM D 5801	8 Min.
Tenacity, 77ºF (25ºC), in-lb	ASTM D 5801	5.3 Min.
Asphaltenes, percent W	ASTM D 2007	16 Max.
Saturates, percent W	ASTM D 2007	20 Max.
(a) Torsional recovery measurement to include first 30 seconds. (b) Determine the distillation by AASHTO T 59 with modifications to include a 300±5ºF (149±3ºC) maximum temperature to be held for 15 minutes.		

2.3 HOT-POUR CRACK SEALANT FOR BITUMINOUS CONCRETE

A. Combine a homogenous blend of materials to produce a sealant meeting properties and tests in Table 22.

B. Packaging and Marking: Supply sealant pre-blended, pre-reacted, and pre-packaged in lined boxes weighing no more than 30 lb.
   1. Use a dissolvable lining that will completely melt and become part of the sealant upon subsequent re-melting.
   2. Deliver the sealant in the manufacturer's original sealed container. Clearly mark each container with the manufacturer's name, trade name of sealant, batch or lot number, and recommended safe heating and application temperatures.

Table 22

Hot-Pour Bituminous Concrete Crack Sealant			
Application Properties			
Workability:	Pour readily and penetrate 0.25 inch and wider cracks for the entire application temperature range recommended by the manufacturer.		
Curing:	No tracking caused by normal traffic after 45 minutes from application.		
Asphalt Compatibility: ASTM D 5329, Section 14.	No failure in adhesion. No formation of an oily ooze at the interface between the sealant and the bituminous concrete or softening or other harmful effects on the bituminous concrete.		
Material Handling:	Follow the manufacturer's safe heating and application temperatures.		
Test Method	**Property**	**Minimum**	**Maximum**
AASHTO T 51	Ductility, modified, 1cm/min, 39.2ºF (4ºC), cm	30	
UDOT method 967	Cold Temperature Flexibility	no cracks	
AASHTO T 300 (a)	Force-Ductility, lb force		4
ASTM D 5329	Flow 140ºF (60ºC), 5 hrs 75º angle, mm		3
ASTM D 3405 (b)	Tensile-Adhesion, modified	300%	
AASHTO T 228	Specific Gravity, 60ºF (15.6ºC)		1.140
ASTM D 5329	Cone Penetration, 77ºF (25ºC), 150 g, 5 sec., dmm		90
ASTM D 5329	Resilience, 77ºF (25ºC), 20 sec., percent	30	
ASTM D 4402	Viscosity, 380ºF (193.3ºC), SC4-27 spindle, 20 rpm, Cp		2500
ASTM D 5329	Bond as per ASTM D 1190, Section 6.4		Pass
(a) Maximum of 4 lb force during the specified elongation of 30 cm @ 1 cm/min, 39.2ºF (4ºC).			
(b) Use ASTM D 3405, Section 6.4.1. Delete bond and substitute tensile-adhesion test in accordance to D 5329.			

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 02765

PAVEMENT MARKING PAINT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish Acrylic Water Based pavement marking paint. Refer to this Section, article 2.2 for resin requirement.

B. Apply to hot mix asphalt or portland cement as edge lines, center lines, broken lines, guidelines, contrast lines, symbols, and other related markings.

C. Remove pavement markings.

1.2 RELATED SECTIONS Not Used

1.3 REFERENCES

A. AASHTO M 247: Standard Specification for Glass Beads Used in Traffic Paints

B. ASTM D 562: Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer

C. ASTM D 2205: Standard Guide for Selection of Tests for Traffic Paints

D. ASTM D 2743: Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography

E. ASTM D 2805: Standard Test Method for Hiding Power of Paints by Reflectometry

F. ASTM D 3723: Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing

G. ASTM D 3960: Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

H. ASTM D 4451: Standard Test Method for Pigment Content of Paints by Low-Temperature Ashing

I. ASTM D 5381: Standard Guide for X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders

J. ASTM E 1347: Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

K. Federal Standards

L. Manual on Uniform Traffic Control Devices (MUTCD)

M. UDOT Materials Manual of Instruction, Part 8

N. UDOT Minimum Sampling and Testing Requirements

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS Not Used

1.6 ACCEPTANCE

A. Provide documentation of the manufacturer and production batch identification for the paint used.

B. Provide fixtures such as ball valves, gate valves, or others on paint truck for the purposes of obtaining field samples.

C. Agitate the paint to allow for thorough mixing. Follow paint manufacturer's recommendation for agitation and mixing times.

D. Stop all agitation before sample is drawn.

E. Calibrate all meters on the paint truck annually and certify for application rate verification.
   1. Use the following calibration tolerances for meters:
      a. Paint: ± 0.1 gal
      b. Beads: ± 0.5 lb/gal
   2. Keep a clean, legible copy of calibration report with the paint truck.
   3. Provide a copy of certification at the Engineer's request.

F. The Engineer will:
   1. Visually inspect lines, legends, symbols, and messages to verify compliance with the required dimensions.
   2. Inspect at a minimum at the end of each production day.

3. Verify quantities applied by either of the following methods:
   a. Measuring both paint and bead tanks prior to and after application.
   b. Witnessing the meter readings prior to and after application.
      1) A printout of meter readings, in lieu of witnessing, may be accepted at the Engineer's discretion.
4. Sample in accordance with the UDOT Materials Manual of Instruction, Part 8-932 and the UDOT Minimum Sampling and Testing Requirements.

G. Repaint any line or legend failing to meet bead adherence and dimensional requirements.

H. Price Reductions. When more than one of the requirements of the pavement markings is deficient, the result with the highest price reduction governs.
   1. Price reductions for pavement markings installed below the specified wet mil thickness are outlined in Table 1.

Table 1

Price Reduction for Wet Mil Thickness	
	Pay Factor
At the specified mil thickness	1.00
1-10 percent below the Specified wet mil thickness	0.75
11-15 percent below the Specified wet mil thickness	0.50
More than 15 percent below the Specified wet mil thickness	0.00 *

* Repaint pavement markings at no cost to UDOT.

   2. Price reductions for pavement markings installed below the specified total solids, pigment, and non-volatile vehicle content (shown in table 4) are outlined in Table 2.

Table 2

Price Reduction for Total Solids, Pigment and Non-Volatile Vehicle	
	Pay Factor
At or above the specified percentage	1.00
Up to 0.5 percent below the specified percentage	0.85
0.5 to 1.0 percent below the specified percentage	0.70
More than1.0 percent below the specified percentage	0.00 *

* Repaint pavement markings at no cost to UDOT.

3. Price reductions for pavement markings that fail to meet the remaining requirements of Table 4 are outlined in Table 3.

Table 3

Price Reductions	
	Pay Factor
At the specified requirements	1.00
Up to1 percent deficient	0.90
1 to 2 percent deficient	0.80
2 to 3 percent deficient	0.70
3 to 4 percent deficient	0.60
4 to 5 percent deficient	0.50
More than 5 percent below specified quantitative requirements	0.00 *

* Repaint pavement markings at no cost to UDOT.

PART 2 PRODUCTS

2.1 PAINT

A. Meet the requirements for Acrylic Water Based Paint as listed in Table 4:

Table 4

Paint Requirements				
Property	White	Yellow	Black	Test
Pigment: Percent by weight	63.0	63.0	63.0	ASTM D 3723
Total Solids: Percent by weight, minimum	79.0	79.0	79.0	ASTM D 2205
Nonvolatile vehicle: Percent by weight vehicle, minimum*	43.0	43.0	43.0	ASTM D 2205
Viscosity, KU @ 77 degrees F	80 - 95	80 - 95	80 - 95	ASTM D 562
Density, lb/gal	14.1 ± 0.3	14.1 ± 0.3	14.1 ± 0.3	ASTM D 2205
Volatile Organic Content (VOC): lb/gal, maximum	1.25	1.25	1.25	ASTM D 3960
Titanium Dioxide Content, lb/gal	1.0 min	0.2 max	N/A	ASTM D 5381
Color Definition	37875	33538	N/A	Federal Standard 595B
Directional Reflectance Minimum	90.0	50.0	N/A	ASTM E 1347
Dry Opacity: Minimum (5 mils wet)	0.95	0.95	N/A	ASTM D 2805

* Binder: 100 percent acrylic cross-linking polymer, by weight, as determined by infrared analysis and other chemical analysis available to UDOT. Refer to ASTM D 2205.

B. No-Pick-Up Time
   1. Paint may not smear or track three minutes after application to the roadway using standard application equipment, at the mil thickness required, and with an ambient shaded temperature of at least 50 degrees F.

C. Additional requirements:
   1. Free of lead, chromium, or other related heavy metals. Refer to ASTM D 5381.
   2. Refer to ASTM D 2743, ASTM D 4451 and ASTM D 5381: Tests used to verify paint samples meet ASTM requirements.

2.2 GLASS SPHERES (BEADS) USED IN PAVEMENT MARKING PAINT

A. Specific Properties: Meet AASHTO M 247 with the following exceptions.
   1. Gradation:

Passing a No. 14 sieve, percent	95 - 100
Passing a No. 16 sieve, percent	80 - 95
Passing a No. 18 sieve, percent	10 - 40
Passing a No. 20 sieve, percent	0 - 5
Passing a No. 25 sieve, percent	0 - 2

   2. Beads: Silane adhesion coating.
   3. Roundness - The glass beads will have a minimum of 80 percent true spheres.

B. Beads used in Temporary Pavement Markings meet the above or AASHTO M 247 Type II uniform gradation.

PART 3 EXECUTION

3.1 PREPARATION

A. Line Control.
   1. Establish control points at 100 ft intervals on tangent and at 50 ft intervals on curves.
   2. Maintain the line within 2 inches of the established control points and mark the roadway between control points as needed.
      a. Remove paint that is not placed within tolerance of the established control points and replace at no expense to the Department. Refer to this Section, article 3.4.

b. Maintain the line dimension within 10 percent of the width and length dimensions defined in Standard Drawings.

B. Remove dirt, loose aggregate and other foreign material and follow manufacturer's recommendations for surface preparation.

3.2 APPLICATION

A. Apply Pavement marking paint at the following wet mil thickness requirements.

1. 20 – 25 wet mils for all longitudinal markings.

Example Calculation: (Verify wet mil thickness)

$$\text{Wet Mils} = \frac{(0.133681\ ft^3/gal) * 12000\ mil/ft}{(X\ ft/gal)(Z\ ft)}$$

Where
X = application rate. (Meter readings or dipping tanks).
Z = line width measured in feet.
12000 = conversion from ft to mil
0.133681 = conversion from gallons to cubic feet.

For information only: Approximate application rate for required mil thickness requirements.

a. 4 inch Solid Line: From 190 to 240 ft/gal
b. 4 inch Broken Line: From 760 to 960 ft/gal
c. 8 inch Solid Line: From 95 to 120 ft/gal

2. 23 – 40 wet mils for all painted legends as determined by a wet mil gauge.

B. Refer to Table 1 for pavement markings that are less than required wet mils in thickness.

C. No additional payment for pavement markings placed in excess of required wet mils in thickness or exceeding dimensional requirements outlined in this Section, article 3.1 paragraph A.

D. Glass Sphere (Beads): Apply a minimum of 8 lb/gal of paint, the full length and width of line and pavement markings.

1. Do not apply glass beads to contrast lines (black paint).

E. Begin striping operations no later than 24 hours after ordered by the Engineer.

F. At time of application apply lines and pavement markings only when the air and pavement temperature are:
   1. 50 degrees F and rising for Acrylic Water Based Paint.

G. Comply with TC Series Standard Drawings.

3.3 CONTRACTOR QUALITY CONTROL

A. Application Rate: Verify that the paint and beads are being applied within specified tolerances prior to striping.

B. Curing: Protect the markings until dry or cured. In the event that the uncured marking is damaged the marking will be reapplied and track marks left on the pavement will be removed at no additional cost to the Department.

3.4 REMOVE PAVEMENT MARKINGS

A. Use one of these removal methods:
   1. High pressure water spray,
   2. Sand blasting,
   3. Shot blasting,
   4. Grinding.

   Grinding is not allowed on the final surfacing unless the Engineer grants prior written approval.

B. Do not eliminate or obscure existing striping, in lieu of removal, by covering with black paint or any other covering.
   1. The Engineer may grant prior written approval for use of black paint or other obscuring material for work durations shorter than "long term stationary" as defined in the Temporary Traffic Control section of the MUTCD.

C. Use equipment specifically designed for removal of pavement marking material.

END OF SECTION

SECTION 02771

CURBS, GUTTERS, DRIVEWAYS, PEDESTRIAN ACCESS RAMPS, AND PLOWABLE END SECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing curbs, gutter transitions, driveways, pedestrian access ramps, and plowable end sections.

1.2 RELATED SECTIONS

A. Section 02056: Embankment, Borrow, and Backfill

B. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork

C. Section 03055: Portland Cement Concrete

D. Section 03152: Concrete Joint Control

E. Section 03211: Reinforcing Steel and Welded Wire

F. Section 03310: Structural Concrete

G. Section 03390: Concrete Curing

H. Section 05120: Structural Steel

1.3 REFERENCES **Not Used**

1.4 DEFINITIONS **Not Used**

1.5 SUBMITTALS **Not Used**

1.6 ACCEPTANCE

A. Curbs, gutters, driveways, disabled pedestrian ramps and plowable end sections may be accepted at a reduced price when the concrete strength is below that specified.
   1. Price adjustment pay factor following Section 03055.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. Class AA(AE). Refer to Section 03055.

2.2 EXPANSION JOINT FILLER

A. Preformed material. Refer to Section 03152.

2.3 UNTREATED BASE COURSE

A. Refer to Section 02056.

2.4 STEEL

A. Reinforcing: Refer to Section 03211. Deformed billet-steel reinforcing bars as specified.

B. Structural: Refer to Section 05120. As specified or as indicated on the plans.

2.5 DETECTABLE WARNING SURFACE

A. Detectable Warning Surface – In-line truncated dome pattern that meets the requirements of GW Series Standard Drawings. Provide a color that contrasts visually with the adjoining surfaces, either light-on-dark or dark-on-light. Acceptable products for installation are as follows:

1. Polymer Composite Panel – Polymer Composite, homogenous integral color (UV stable), skid resistant, non-glare finished panel. Use for new construction or retrofit construction.
2. Precast Concrete Panel – High strength concrete with high tensile stainless steel tendons, homogeneous integral color (UV stable), skid resistant panel. Use for new construction, or retrofit construction.

PART 3 EXECUTION

3.1 PREPARATION

A. Construct subgrade to plan elevations. Refer to Section 02056.

B. Place and compact fill material and untreated base course. Refer to Section 02056.

C. May use a slip form curb and gutter machine.

D. Dampen the untreated base course before placing concrete.

E. Curbs and Gutters: Refer to GW Series Standard Drawings.

F. Pedestrian Access Ramp: Refer to GW Series Standard Drawings.

G. Plowable End Section: Refer to GW Series Standard Drawings.

H. Forms: Refer to Section 02776.

3.2 PLACE CONCRETE

A. Furnish materials and construct structural concrete. Refer to Section 03310.
   1. Do not use mechanical vibrators.
   2. Hand tamp forms to eliminate honeycomb.
   3. Deposit concrete continuously when using a slip form machine.
   4. Use dowels as shown on the plans when placing curb on existing pavement.

3.3 FINISH CONCRETE

A. Round edges to a ½ inch radius.

B. Use a float to finish the top and front face of the curb and the top of the gutter.

C. Finish the traveled portion of the driveway with a broom finish.

D. Remove form marks or irregularities from finish surfaces.

3.4 JOINTS

A. Place joints perpendicular to the subgrade and as shown.

B. Contraction joints:
   1. ⅛ inch to $^{3}/_{16}$ thick steel plates.
   2. Space the joints every 10 ft.
   3. Remove the templates as soon as the concrete takes an initial set.
   4. Cut joint 1½ inches deep when using slip form method to place the concrete.

C. Expansion Joints:
   1. Place expansion joint every 30 ft.
   2. Expansion joint not required when using slip form method to place concrete, except at adjacent pavement, curb radius, sidewalk, or structures.
   3. ½ inch thick premolded expansion joint filler.
   4. Place joint filler between the curb and gutter and sidewalk, or structures.

3.5 CURE AND PROTECT CONCRETE

A. Cure the surface. Refer to Section 03390.

B. Seal the surface after curing. Refer to Section 03390.

3.6 DETECTABLE WARNING SURFACE

A. Polymer Composite Panel Installation:
   1. Install cast-in-place detectable warning panel directly into the finished plastic concrete surface in accordance with manufacturer recommendations. Provide a smooth transition between the panel and the surrounding concrete surface.
   2. Install surface applied detectable warning panel directly on existing concrete surface in accordance with manufacturers recommendations and installation procedures. Use mechanical fasteners to secure the panel to the existing surface. Caulk a smooth transition bead along beveled panel edge and surrounding concrete surface.

B. Precast Concrete Panel Installation:
   1. Place as shown on drawings. Install per manufacturer recommendations for cast-in-place or thin set method. Provide a smooth transition between the panel and the surrounding concrete surface.

END OF SECTION

SECTION 02912

TOPSOIL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and spread topsoil on prepared areas.

B. Strip topsoil from on-site locations and place in stockpile.

C. Spread stockpiled topsoil on prepared areas.

1.2 RELATED SECTIONS Not Used

1.3 REFERENCES

A. AASHTO T 194: Determination of Organic Matter in Soils by Wet Combustion

B. Textural Triangle National Soils Handbook

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. For Contractor-furnished topsoil: A minimum of 7 working days before delivery of soil, submit to the Engineer the laboratory test results from each topsoil source to be used.

PART 2 PRODUCTS

2.1 CONTRACTOR FURNISHED TOPSOIL

A. Determine PH, EC, and SAR with a saturated soil paste or 1:1 soil/water testing method. Meet the following:
   1. **PH**: 6.0 to 8.0
   2. **EC**: (Electrical Conductivity): less than 4 ds/m
   3. **SAR**: (Sodium Adsorption Ratio): less than 10.

B. Organic matter:
   1. 1 to 20 percent.
   2. Determined by the release upon combustion, Walkley-Black or modified Walkley-Black testing method. AASHTO T 194.

C. Textural classification:
   1. Loam, sandy loam, silt loam, or sandy clay loam not exceeding the following percentiles. Refer to Textural Triangle National Soils Handbook, Part 603-5.

Table 1

Textural Classification	
Soil Component	**Percentile Range**
Sand	20 to 70
Silt	20 to 70
Clay	10 to 30

   2. Determine particle size analysis by the hydrometer testing method.

D. Topsoil free of:
   1. Subsoils (no B or C horizon soils)
   2. Coarse sand and gravel
   3. Stiff clay, hard clods or hard pan soils
   4. Rock larger than 3 inches in any dimension
   5. Trash, litter or refuse
   6. Noxious weeds and weed seeds.

E. Topsoil may contain a maximum of 5 percent rock smaller than 3 inches.

2.2 SOURCE QUALITY CONTROL – CONTRACTOR FURNISHED MATERIAL

A. Obtaining Soil Samples:
   1. Obtain soil samples while the Engineer is present. Provide no less than ½ lb per soil sample.
   2. Obtain samples from a thin slice of soil cut from the side of a freshly dug hole or by using a soil auger or sampling tube.
   3. Mix the several small samples taken from various places around the source together to produce a composite sample.
   4. More than one composite sample may be required if the topsoil horizon changes significantly across the source.
   5. Store samples in a clean container at room temperature and out of direct sunlight.
   6. Label the location and date on each sample container.

7. Provide additional soil samples for verification if requested by the Engineer.

B. Soil testing: Engineer will submit soil samples to an approved independent soil testing laboratory capable of performing the tests listed in this section, article 2.1, Contractor Furnished Topsoil. A partial list of acceptable testing laboratories includes:

Brigham Young University
Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
(801) 422-2147

USU Analytical Laboratory
4830 Old Main Hill
Logan, Utah 84322-4830
(435) 797-2217

QA Consulting and Testing, LLC
PO Box 627
645 South 240 East
Salem, UT 84653
(801) 423-1116
(801) 423-1813 (fax)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Complete final grading, trench settling and surface preparation before placing topsoil.

B. Place and spread topsoil as the slope is being constructed on steep cut slopes steeper than 2:1 and higher than 15 feet that require the placement of topsoil. Finish according to this Section, article 3.3, Spread Stockpiled and Contractor-Furnished Topsoil, paragraph D.

C. Provide a suitable topsoil surface just before seeding on the remaining top soiled areas not covered under this article, paragraph B. Suitable topsoil surface is:
1. Non-compacted surface finished according to this Section, article 3.3.
2. Weed free.

3. Finish grade provides a uniform surface with smooth transitions between grade changes and disturbed areas.

D. Do not strip or handle wet topsoil.

E. Establish finish grade at 1 inch below the top of all walks, curbs, mow strips and other hard surfaces for areas receiving seed or turf seed and 1½ inch for areas receiving turf sod.

3.2 STRIP AND STOCKPILE TOPSOIL

A. Strip the topsoil
   1. Only from areas identified on the plans or approved by Engineer.
   2. To a depth approved by the Engineer.

B. Remove and dispose of any roots larger than 2 inches in diameter or 12 inches in length.

C. Stockpile stripped topsoil:
   1. At locations acceptable to the Engineer.
   2. So that placement or activity around the stockpile does not damage or impact any existing trees, shrubs or environmentally sensitive areas. Obtain appropriate clearances if such impacts are unavoidable.

D. Grade to minimize erosion on and around the stockpiles.

3.3 SPREAD STOCKPILED AND CONTRACTOR-FURNISHED TOPSOIL

A. Clear area to receive topsoil of all trash, debris, weeds, and rock 3 inches or larger, and dispose of objectionable material in an approved manner.

B. Place and spread the stockpiled topsoil over the prepared slopes to the plan depths.

C. Disc or harrow the placed topsoil along the contour on slopes 3:1 and flatter or cat-track the slopes to create continuous cleat tracks that run parallel with the contours.

D. Cat-track slopes steeper than 3:1 to create continuous cleat tracks that run parallel with the contours.

END OF SECTION

SECTION 02922

SEED, TURF SEED, AND TURF SOD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seed, turf seed, and turf sod requirements and application.

B. Surface preparation.

1.2 RELATED SECTIONS

A. Section 02912: Topsoil

1.3 REFERENCES

A. Utah Seed Law

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Copy of the purchase order to the Engineer documenting that all seeds, including substitutions, have been acquired before the seeding window begins.
   1. Refer to this Section, article 1.6, Scheduling for seeding information.
   2. List the common and botanical name for each seed species on the purchase order.

B. Certification that turf sod is nursery grown and contains a minimum of three varieties of Kentucky Blue Grass.

C. Certification indicating the date and time sod was cut at the nursery.

D. Furnish fertilizer labels to Engineer.

E. Through the Engineer, supply legible copy of Seed Certification Reports to Region Landscape Architect.

F. Seed certification: Include the following on seed certification reports and labels:
   1. Botanical name (include variety if applicable)
   2. Common name
   3. Name of seed testing laboratory
   4. Lot number and address of the seed company
   5. Weed seed (percent)
   6. Other crop seed (percent)
   7. Inert matter (percent)
   8. Pure live seed (percent)
   9. Noxious weed seed (name and rate of occurrence)
   10. Date tested (month and year)
   11. Germination (percent)
   12. Hard seed (percent)
   13. Net weight (do not include container weight)
   14. Pure live seed weight
   15. Collection locations for native shrub and tree species (state, county, elevation)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Mixing Seed:
   1. Notify Engineer seven calendar days prior to seed mixing.
   2. Engineer will verify that the seed certification report or label represents the seed lot from which the seed is furnished.
   3. Mix the different seed varieties to provide an even blend.
   4. Bag the mixed seed, seal the container, and attach a signed UDOT label to the exterior.

B. Deliver seed or turf seed to job site in original containers showing analysis of seed mixture, net weight, and date and location of packaging. Damaged packages are not acceptable.

C. Strip turf sod from nursery no more than 24 hours before laying.

D. Deliver fertilizer in containers showing weight, chemical analysis, and name of manufacturer. Store fertilizer in a weatherproof location.

1.7 SCHEDULE

A. Pre-measure the area to be seeded before ordering seed from supplier. The Engineer must approve the measuring technique and determined quantity.

B. Seeding Window: Complete all general roadside seeding within the appropriate seeding window.
   1. Postpone seeding until the following year if the seeding is not completed within the given window.
   2. Exception to this window under certain conditions may be obtained through the Region Landscape Architect. The Engineer approves exceptions.

Elevation	Seeding Window
Below 4,000 ft	Oct. 1 to Dec. 31
4000 to 6,000 ft	Sept. 15 to Dec 1
Above 6,000 ft	Sept. 1 to Nov 15

C. Turf seed and turf sod can be placed only after irrigation system is installed and operational.

D. Topsoil: Refer to Section 02912.
   1. Place topsoil just before seeding to eliminate competition from weeds.
   2. Coordinate topsoil placement with the above seeding window.

PART 2 PRODUCTS

2.1 SEED AND TURF SEED

A. Meet the Utah Seed Law: Utah Code - Title 4, Chapter 16.

B. Supply seed on a pure live seed (PLS) basis.

C. Obtain seed from lots that have been tested by a state certified seed testing laboratory. Association of Seed Analyst (AOSA) or Society of Commercial Seed Technologists (SCST).
   1. Seed germination test older than 18 months for grass seed, and nine months for shrub, or tree seed are not acceptable.
   2. Based on the amount or type of seed required on a project, UDOT may require additional testing by the Department of Agriculture.

D. Do not use wet, moldy, or otherwise damaged seed.

E. Seed Substitutions
   1. Contact the major seed brokers in the state to verify that the seed is unavailable before requesting a seed substitution.
   2. Engineer will contact the Region Landscape Architect to verify the seed is unavailable and to recommend a seed substitution.
   3. Replace originally specified seed with seed of equal or greater cost.

2.2 TURF SOD

A. Healthy and well-rooted nursery grown Kentucky Blue Grass sod comprised of a minimum of three varieties and free of weeds.

B. Machine cut in straight, uniform strips or rolls, cut at a depth between ¾ inch and 1 inch.

2.3 FERTILIZER (For turf sod and turf seed areas only)

A. Uniform in composition, dry, and free flowing.
   1. For turf seed or turf sod: Elemental nitrogen in granular form. Phosphorus, and potassium are optional and may be applied with nitrogen in granules. A minimum of 50 percent of nitrogen shall be in a slow release form such as sulfur coated urea or urea formaldehyde.
   2. Apply elemental nitrogen with a concentration ranging from 21-34 percent if hydroseeding method is used.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete all final grading, irrigation work, trench settling, topsoil placement, and surface preparation before seed or sod application.

B. Prepare General Seedbed for all seeded and sodded areas.
   1. Before any seed or sod work begins, properly prepare the topsoil surface and have it approved by the Engineer. Refer to Section 02912.
   2. Do not work topsoil or seed when the soil is saturated or frozen.

C. Prepare Turf Seedbed:
   1. Review finish grade to confirm that topsoil is 1 inch below the top of all walks, curbs, mow strips and other hard surfaces.
   2. Apply fertilizer at the rate of 2 lb/100 yd^2 and mix thoroughly into upper 2 inches of topsoil.
   3. Do not apply fertilizer and seed at the same time in the same machine.

D. Prepare Turf Sod Surface:
   1. Review finish grade to confirm that topsoil is 1½ inch blow the top of all walks, curbs, mow strips and other hard surfaces.
   2. Apply fertilizer at the rate of 2 lb/100 yd^2 and mix thoroughly into upper 2 inches of topsoil.
   3. Level and roll prepared areas using a 21 gal water-filled hand roller containing 8 gallons to 10 gallons of water.
   4. Lightly rake and dampen with water the top ⅛ to ⅝ inches of soil just before laying the sod.

3.2 SEEDING

A. Notify the Engineer seven working days before seeding.

B. Apply seed at the rate indicated in the Seed Schedule shown in the plans. Note that drill seed and broadcast seed are applied at different rates.

3.3 DRILL METHOD

A. Use the drill method of seeding on accessible slopes 3:1 and flatter.

B. Use a rangeland type drill equipped with the following:
   1. Depth band
   2. Seed box agitator
   3. Seed metering device
   4. Furrow opener
   5. Packer wheels or drag chains

C. Provide the Engineer a copy of the manufacturer's directions on drill calibration two working days before seeding.

D. Use the drill manufacturer's directions in the presence of the Engineer. Calibrate the drill to apply seed at the rate indicated in the seeding schedule.

E. Space drill rows a minimum of 6 inches and a maximum of 8 inches.

F. Fill the seed boxes no more than half full when drilling on a slope.

G. Set depth bands to drill seeds to a ½ inch depth.

H. Drill along the contour.

I. Maintain the drill at the calibrated setting throughout the seeding operation.

J. Allow the furrows that are created by the drill to remain.

3.4 BROADCAST METHOD

A. Use the broadcast method of seeding under the following conditions:
   1. Slopes steeper than 3:1.
   2. Slopes 3:1 and flatter where the area to be seeded is inaccessible to drill.
   3. Where the area to be seeded is not large enough to justify using a drill.
   4. Where rocky surface conditions would damage a drill.

B. Obtain approval of the broadcast method by demonstrating the procedure on a 100 yd^2 area.

C. Evenly broadcast seed using either:
   1. A cyclone seeder or other approved mechanical seeder.
   2. A hydroseeder
      a) Apply seed, water and 300 lb of cellulose fiber mulch (tracer) per acre.

D. Do not seed during windy weather or when soil is saturated.

E. Incorporate the seed into the soil by one of three methods:
   1. Cat-tracking, running the dozer up and down the slope, creating continuous cleat tracks that run parallel with the contours.
   2. Hand raking the seed in ½ inch deep and along the contours of the slope. Slope chaining by pulling the chain along the contour until the seed is covered.

F. Obtain approval from the Engineer that the seed has been adequately incorporated into the soil before applying mulch, blanket, or other topdressing.

3.5 TURF SEEDING

A. Apply turf seed after seedbed preparation. Refer to this Section, article 3.4, paragraph C.

B. Roll seeded areas using a hand roller half filled with water

C. Lightly water and program the irrigation system to maintain a moist seedbed.

D. Rope-off newly seeded areas along walkways using bright plastic ribbon tape attached to stakes.

3.6 LAY SOD

A. Refer to this Section, article 1.6, paragraph C for timing.

B. Prepare sod bed and place sod with all edges and joints tightly butted.
   1. Do not stretch or overlap sod.
   2. Keep length seams in a straight line.

C. Lay turf sod with staggered joints and trim off excess material along the edges.

D. Roll sod immediately after placing using a hand roller half filled with water.
   1. Re-roll if depressions still remain.
   2. Thoroughly water with a fine spray to a depth sufficient that the underside of the new sod and soil immediately below the sod are thoroughly wet.

END OF SECTION

SECTION 03055

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for producing portland cement concrete.

1.2 RELATED SECTIONS Not Used

1.3 REFERENCES

A. AASHTO M 6: Standard Specification for Fine Aggregate for Portland Cement Concrete

B. AASHTO M 80: Standard Specification for Coarse Aggregate for Portland Cement Concrete

C. AASHTO M 154: Standard Specification for Air-Entraining Admixtures for Concrete

D. AASHTO M 157: Standard Specification for Ready-Mixed Concrete

E. AASHTO M 194: Standard Specification for Chemical Admixtures for Concrete

F. AASHTO M 295: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

G. ASTM C 150: Standard Specification for Portland Cement

H. ASTM C 595: Standard Specification for Blended Hydraulic Cements

I. ASTM C 1157: Standard Performance Specification for Hydraulic Cement

J. ASTM C 1240: Standard Specification for Silica Fume for Used in Cementitious Mixtures

K. ASTM C 1567: Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

L. ASTM C 1602: Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

M. American Concrete Institute (ACI) Standards

N. Precast/Prestressed Concrete Institute (PCI)

O. UDOT Materials Manual of Instruction

P. UDOT Minimum Sampling and Testing Requirements Manual

Q. UDOT Quality Management Plan

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Furnish to the Engineer a mix design for each class of concrete to be used.
   1. Base concrete mix designs for all "A" concrete classes on trial batch test results or on UDOT's past project history using the same materials used in previous mix designs within the past year.
   2. Use the same components in the trial batches that are to be used in the project including coarse and fine aggregate, water, source and type of cement, air-entraining agent, fly ash, etc., including any site-added admixtures intended to be used.
   3. Do not exceed 30 percent total pozzolan in any mix unless otherwise specified.
   4. The Department or its representative witnesses the trial batch.
   5. Mix concrete trial batches as specified in UDOT Materials Manual of Instruction Part 8-974: Guidelines for Portland Cement Concrete Mix Design.
   6. Meet the following additional requirements for Self Consolidating Mixes (SCC):
      a. Design and mix according to ACI Manual of Concrete Practice 301: Specifications for Concrete.
      b. Provide mix specific flow and spread criteria.
      c. Meet PCI – TR-6-03. A visual stability index rating of 0 – 1 is required.
      d. Provide compressive strength data.
      e. Include documentation justifying any deviation from the aggregate operating bands required by Table 4 with the mix design for approval. Production may not begin until the deviation is approved.

B. Test results verifying the coarse and fine aggregate used meets this section, article 2.2

C. Verification that cement used is from a pre-qualified supplier. See this Section, article 2.1, paragraph E.

D. Verification that fly ash used in from a pre-qualified supplier. See this Section, article 2.5, paragraph A.1.d.

E. Verification that the batch plant meets the requirements of the UDOT Quality Management Plan for Ready-Mix Concrete.

1.6 ACCEPTANCE

A. Acceptance is in accordance with UDOT Minimum Sampling and Testing Requirements.

B. When concrete is below specified strength and does not have a separate strength pay factor:
   1. Department may accept item at a reduced price.
   2. The pay factor will be applied to the portion of the item that is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows based on 28 day compressive strength:

Psi below specified strength:	**Pay Factor:**
1 – 100	0.95
101 – 200	0.90
201 – 300	0.85
301 – 400	0.80
More than 400	0.50 or Engineer may reject

PART 2 PRODUCTS

2.1 CONCRETE CLASSES AND MIX REQUIREMENTS

A. Meet the requirements in Table 1.

Table 1

Concrete Classes and Mix Requirements							
Class	Coarse Aggregate or Sieve Size	Max. Water/ Cementitous Ratio	Min. Cementitous Content (lb/yd^3)	Slump (Inch) See Article G for further Criteria	Air Content Percent (%)*	Mix Design Compress *f*cr (Psi)	28 Day Minimum Compress *f*c (Psi) **
AA(AE)	2" to No. 4	0.44	564	1 to 3.5	4.0 - 7.0	5200	4000
	1-½" to No. 4	0.44	564	1 to 3.5	4.5 - 7.5	5200	4000
	1" to No. 4	0.44	611	1 to 3.5	5.0 - 7.5	5200	4000
	¾" to No. 4	0.44	611	1 to 3.5	5.0 - 7.5	5200	4000
A(AE)	1-½" to No. 4	0.53	470	1 to 3.5	4.5 - 7.5	3900	3000
	1" to No. 4	0.53	470	1 to 3.5	4.5 - 7.5	3900	3000
	¾" to No. 4	0.48	517	1 to 3.5	4.5 - 7.5	3900	3000
B or B(AE)		0.62	376	2 to 5	-- 3.0 - 6.0	3250	2500

* Values listed represent in-place air content. Make necessary adjustments for impacts to air content due to placement.

** For *f*'c over 4000 psi, design and proportion mixes according to ACI Manual of Concrete Practice 301: Specifications for Concrete and project specific criteria.

B. Minimum strength is based on a coefficient of variation of 10 percent, and one test below the minimum strength per 100 tests.

C. Maximum nominal size of coarse aggregate:
   1. Not larger than $^1/_5$ of the narrowest dimension between sides of forms.
   2. Not larger than ⅓ the depth of slabs.
   3. Not larger than ¾ of the minimum clear distance between reinforcing bars or between bars and forms, whichever is less.

D. Do not exceed water/cementitous ratio.

E. Calculate the water/cementitous ratio (w/c) according to the following formula:

$$\frac{W}{C} = \frac{Water}{Cement + Pozzolan}$$

F. Use 94 lb more cement per cubic yard when concrete is deposited in water than the design requires for concrete placed above water.

G. Use Table 4 to determine the slump requirements when not using water-reducing admixtures or viscosity modifying admixtures.
   1. Slump requirements when using low range water reducers: 1 inch to 5 inches for all classes of concrete.
   2. Slump requirements when using high range water reducers: 4 inches to 9 inches for all classes of concrete.
   3. Slump requirements when using viscosity modifying admixtures: None. Meet visual stability index of 0 – 1.

2.2 CEMENT

A. Use type II portland cement or blended hydraulic cement unless otherwise specified. (ASTM C 150, ASTM C 595, ASTM C 1157)

B. Portland Cement
   1. Follow Tables 1 and 3 in ASTM C 150.
   2. Follow the requirements of Table 2 of ASTM C 150 for low-alkali cement.

C. Blended Hydraulic Cement.
   1. When blended hydraulic cement is substituted for portland cement:
      a. Use ASTM C 1567 to verify that expansion is less than 0.1 percent at 16 days.
      b. Refer to the equivalent cements listed in Table 2.
   2. Do not exceed 30 percent total pozzolan limit when adding flyash to a blended hydraulic cement.
      a. Submit documentation of the total pozzolan content with the mix design.

Table 2

Portland Cement/Blended Hydraulic Cement Equivalencies		
ASTM C 150 (Low Alkali)	ASTM C 595	ASTM C 1157
Type I	IP	GU
Type II	IP (MS)	MS
Type III	-	HE
Type V	-	HS

D. Do not use cement that contains lumps or is partially set.

E. Use cement from the list of UDOT qualified suppliers list maintained by the UDOT Materials Quality Assurance Section.

F. Do not mix cement originating from different sources.

G. Do not use air-entrained cement.

H. Department will sample and test the cement in accordance with UDOT Quality Management Plan 502: Cement.

2.3 AGGREGATE

A. Coarse Aggregate for Normal Concrete Mixes
   1. Use coarse aggregate meeting AASHTO M 80 physical properties. Use one of the gradations found in Table 2.
   2. Do not exceed 1 percent of deleterious substances as shown in AASHTO M 80, Table 2, for Class A aggregates. Material finer than No. 200 sieve: maximum allowable 1 percent, exception as noted in footnote d.

Table 3

Aggregate Gradations - Percent Passing (by weight)								
Aggregate or Sieve Size (inches)	2½	2	1½	1	¾	½	⅜	No. 4
2 to No. 4	100	95-100		35-70		10-30		0-5
1½ to No. 4		100	95-100		35-70		10-30	0-5
1 to No. 4			100	95-100		25-60		0-10
¾ to No. 4				100	90-100		20-55	0-10

B. Fine Aggregate for Normal Concrete Mixes
   1. Use fine aggregate meeting AASHTO M 6 physical properties. Use the gradation found in Table 3.
   2. Do not exceed 3.0 percent of deleterious substances as outlined in AASHTO M 6, Table 2, for class A aggregates, using option "b" for material finer than the No. 200 sieve. Material finer than No. 200 sieve: maximum allowable 3 percent.

Table 4

Gradation	
Sieve Size	Percent Passing (by weight)
⅜ inch	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

C. Coarse and Fine Aggregate for Self Consolidating Concrete (SCC) Mixes.
1. Combined gradations of coarse and fine aggregates must be within the bands shown in Table 4. Establish targets and production tolerances necessary to meet the requirements of Table 4.

Table 5

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)		
Sieve Size	**¾ inch Operating Bands**	**½ inch Operating Bands**
¾ inch	95 – 100	–
½ inch	65 – 95	95 –100
⅜ inch	58 – 83	65 – 95
No. 4	35 – 65	50 – 80
No. 8	25 – 50	30 – 60
No. 16	15 – 35	20 – 45
No. 30	10 – 35	12 –35
No. 50	5 – 20	5 – 20
No. 100	1 – 12	2 – 12
No. 200	0 – 2	0 – 2

2.4 WATER

A. Use potable water or water meeting ASTM C 1602, including Table 2.

B. Screen out extraneous material when pumping water from streams, ponds, lakes, etc.

2.5 ADMIXTURES

A. Air Entrainment: as specified. Meet AASHTO M 154, including Section 5.

B. Water Reducing Agents: Meet AASHTO M 194.
1. High Range Water Reducer (HRWR): Submit a written plan for approval with the trial batch that shows proper attention will be given to ingredients, production methods, handling and placing.
2. Do not use calcium chloride.

C. Accelerators: Meet AASHTO M 194
1. Use non-chloride accelerators.

D. Set Retarding Admixtures: Meet AASHTO M 194.
1. Establish the effective life of the set-retarding admixture by trial batch if set retarding admixtures are required due to haul times exceeding the time limitations in this Section, article 3.4, paragraph A.

2. Do not exceed any manufacturer recommendations for the use of the set-retarding admixture.
3. Do not re-dose the concrete with additional set retarding admixture.
4. Add set retarding admixture at the batch plant at the time of initial batching operations.
5. Show on batch tickets the amount of admixture used.
6. Time of placement is established by the trial batch and supersedes the requirements in this Section, article 3.4, paragraph A.

E. Viscosity Modifying Admixtures.
1. Do not exceed any manufacturer recommendations for the use of the viscosity modifying admixture.
2. Do not re-dose the concrete with additional viscosity modifying admixture.
3. Show on batch tickets the amount of admixture used.

F. Site-added admixtures.
1. Use admixture in the trial batch.
2. Use pre-measured admixtures only.
3. Record amount used on batch ticket.
4. Rotate the drum at least 30 revolutions at the mixing speed recommended by the manufacturer.

2.6 POZZOLAN

A. Fly Ash:
1. Class F, as specified. Conform to AASHTO M 295 except table 2.
   a. Replace a minimum of 20 percent of the portland cement by weight unless otherwise specified. Use the minimum cement content in the design formulas before replacement is made.
   b. Loss on Ignition (LOI): not to exceed 3 percent.
   c. Maximum allowable CaO content: not to exceed 15 percent.
   d. Use fly ash from the list of UDOT pre-qualified sources maintained by the UDOT Materials Quality Assurance.
   e. Label the storage silo for fly ash to distinguish it from cement.
   f. Use different size unloading hoses and fittings for cement and fly ash.
2. Fly ash may be sampled and tested for compliance at any time.

B. Natural Pozzolan (Class N)
1. Conform to AASHTO M 295.
2. May use instead of fly ash provided that the expansion, according to ASTM C 1567, does not exceed 0.1 percent.

C. Silica Fume: Conform to ASTM C 1240.

PART 3 EXECUTION

3.1 PREPARATION

A. Aggregate stockpiles:
1. Construct stockpile platforms so that subgrades are prevented from intruding into aggregates.
2. Build stockpiles at least two days before use.
3. Provide an operator and front-end loader to help the Engineer take aggregate samples.
4. Aggregate may be accepted in daily increments, but not more than 30 days before use.
5. Provide separate stockpiles for coarse and fine aggregate.
6. Construct stockpiles to minimize segregation of aggregate
7. Allow washed aggregates to drain to uniform moisture content before use (12 hours minimum).

3.2 BATCH MATERIALS

A. Meet AASHTO M 157.

B. Hand Mixing:
1. Only Class B concrete may be hand mixed.
2. Hand-mixed batches cannot exceed 0.5 yd^3.
3. Hand mix on a watertight platform.
4. Spread the aggregate evenly on the platform and thoroughly mix in the dry cement until the mixture becomes uniform in color.

C. Truck-Mixed Concrete (Dry-Batch):
1. Do not load trucks in excess of their rated mixing capacity, or 63 percent of the drum gross volume, or less than 2 yd^3.
2. The truck rating plate must be readable.

3.3 MIX DESIGN

A. Do not place concrete without written approval of the mix design.

B. Do not change the mix design without written approval.

3.4 LIMITATIONS – GENERAL

A. Timing. Unless otherwise specified, place concrete:
   1. Within 90 minutes of batching when the air temperature is below 80 degrees F.
   2. Within 75 minutes of batching when the air temperature is between 80 and 85 degrees F.
   3. Within 60 minutes of batching when the air temperature is between 86 and 90 degrees F.
   4. Prior to initial set.

B. Concrete Temperature: Unless otherwise specified, place concrete in the forms when the concrete temperature is between 50 and 90 degrees F.

C. Pumping and Conveying Equipment
   1. Do not use equipment or a combination of equipment and the configuration of that equipment that causes a loss of entrained air content that exceeds one half of the range of air content allowed by specification.
   2. Contractor is responsible for verification and monitoring of air loss.

3.5 CYLINDER STORAGE DEVICE

A. Provide and maintain cylinder storage device.
   1. Maintain cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial 16-hour curing period.
   2. Do not move the cylinders during this period.
   3. Equip the storage device with an automatic 24-hour temperature recorder that continuously records on a time-temperature chart with an accuracy of ±1 degree F.
   4. Have the storage device available at the point of placement at least 24 hours before placement.
   5. Engineer stops placement of concrete if the storage device cannot accommodate the required number of test cylinders.
   6. Use water containing hydrated lime if water is to be in contact with cylinders.
   7. A 24-hour test run may be required.

END OF SECTION

SECTION 03575

FLOWABLE FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing flowable fill.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete

1.3 REFERENCES

A. AASHTO M 154: Air-Entraining Admixtures for Concrete

B. AASHTO M 194: Chemical Admixture for Concrete

C. ASTM D 4832: Preparation and Testing of Controlled Low Strength Material (CLSM) Test

1.4 DEFINITIONS Not Used

1.5 SUBMITTALS

A. Batch Proportions: Submit to Engineer seven days before placement.

B. Trial Batch:
   1. Submit certified test results or conduct laboratory trial batch to verify strength prior to placement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Refer to Section 03055 Portland Cement Concrete.

B. Pozzolan: Refer to Section 03055 Portland Cement Concrete.

C. Sand.

D. Coarse aggregate: Determine a suitable aggregate size and gradation for the intended application.

E. Admixtures:
   1. Water reducers and set accelerators: AASHTO M 194.
   2. Air entrainment: AASHTO M 154.

PART 3 EXECUTION

3.1 INSTALLATION

A. Combine materials to meet the requirements for strength and constructability as required. Determine strength from trial batches at 28 days.
   1. Minimum strength: 50 psi. ASTM D 4832.
   2. Maximum strength: 150 psi. ASTM D 4832.
   3. Slump: 5 inches to 10 inches.

B. Determine a suitable aggregate size and gradation for the intended application.

END OF SECTION

SECTION 04810 - UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Submittals: In addition to Product Data, submit the following:

1. Samples showing the full range of colors and textures available for exposed masonry units and colored mortar.
2. Material Test Reports: From a qualified testing agency, for each type of masonry unit required; mortar complying with property requirements, and grout complying with compressive strength requirements.
3. Material Certificates: For each type of masonry unit required.

B. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602

C. Hot-Weather Requirements: When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

1.2 PRODUCTS

A. Color and Texture: As selected by Architect from manufacturer's full range.

B. Brick, General: Provide shapes indicated and as follows:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
2. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

C. Face Brick: ASTM C 216 Grade MW or SW and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa)
2. Initial Rate of Absorption: Less than 20 g/30 sq. in. (20 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not efflorescced."
4. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size: Manufactured to the following actual dimensions:
   a. Modular: 3-1/2 to 3-5/8 inches (89 to 92 mm) wide by 2-1/4 inches (57 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.

D. Mortar and Grout Materials: As follows:

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
2. Hydrated Lime: ASTM C 207 Type S.
3. Mortar Cement: ASTM C 1329.
4. Masonry Cement: ASTM C 91.
5. For pigmented mortar, use a colored cement or cement-lime formulation as required to produce the color indicated.
6. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

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

7. Aggregate for Grout: ASTM C 404.
8. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
9. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
10. Water: Potable.

E. Masonry Joint Reinforcement: ASTM A 951mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
2. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
3. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.
4. For multiwythe masonry, provide ladder type with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c. and 1 side rod for each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod for each wythe of masonry 4 inches (100 mm) or less in width] [tab type with single pair of side rods spaced for embedment within each face shell of backup wythe and rectangular box-type cross ties spaced not more than 16 inches (407 mm) o.c.] [adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches (407 mm) o.c. and with separate adjustable veneer ties engaging the cross ties].

F. Ties and Anchors, General: Provide ties and anchors, specified in subsequent paragraphs, made from materials that comply with this paragraph, unless otherwise indicated.

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls.
2. Galvanized Steel Sheet: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, at exterior walls; and ASTM A 653/A 653M, G60 (Z180), commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication at interior walls.

G. Bent Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide, made from 3/16-inch- (4.8-mm-) diameter, galvanized steel wire.

H. Anchors for Connecting to Concrete: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall.

1. Anchor Section: Dovetail anchor section formed from 0.0528-inch- (1.35-mm-) thick, galvanized steel sheet.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.1875-inch- (4.8-mm-) diameter, galvanized steel wire.

I. Adjustable Masonry-Veneer Anchors: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall, for attachment over sheathing to wood or metal studs, and that are capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

1. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a triangular wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom; with raised rib-stiffened strap stamped into center to provide a slot for connection of wire tie.
2. Seismic Masonry-Veneer Anchors: Units consisting of a rib-stiffened, sheet metal anchor section with screw holes top and bottom; with raised rib-stiffened strap stamped into center to provide a slot for a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

J. Embedded Flashing Materials: As follows:

1. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:

   a. Stainless Steel: 0.0156 inch (0.4 mm) thick.

2. Fabricate metal drip edges from sheet metal indicated above. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with a hemmed outer edge bent down 30 degrees.

K. Miscellaneous Masonry Accessories: As follows:

1. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.
3. Cavity Drainage Material: 1-1/2"-inch- (50-mm-)] thick, free-draining mesh; made from polyethylene strands.

L. Masonry Cleaners: As follows:

1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.
2. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

M. Mortar and Grout Mixes: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.
1. Mortar for Unit Masonry: Comply with ASTM C 270 AND BIA M1, Property Specification.

   a. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
   b. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

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

   a. For portland cement-lime mortar, not more than 10 percent.
   b. For mortar cement, not more than 5 percent.

1.3 EXECUTION

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

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

C. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

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

   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
   2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

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

F. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

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

H. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

   1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity.

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

J. Keep cavities clean of mortar droppings and other materials during construction.

   1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

K. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

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

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

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

1. Fasten each anchor section through sheathing to wall framing and concrete backup with two metal fasteners of type indicated.
2. Embed tie sections or connector sections and continuous wire in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610) o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

N. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. Extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.
2. Install metal drip edges beneath flashing at exterior face of wall. Stop flashing 1/2 inch (13 mm) back from outside face of wall and adhere flashing to top of metal drip edge.
3. Install metal flashing termination beneath flashing at exterior face of wall. Stop flashing 1/2 inch (13 mm) back from outside face of wall and adhere flashing to top of metal flashing termination.

O. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated.

1. Use round plastic tubing form weep holes.
2. Space weep holes 16 inches (400 mm) o.c.
3. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

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

1. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

Q. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and the IBC

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

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and the IBCs and for grout placement, including minimum grout space and maximum pour height.

S. Cleaning: Clean unit masonry as follows:

1. By dry brushing to remove mortar fins and smears before tooling joints, as work progresses.
2. After mortar is thoroughly set and cured, clean exposed masonry as follows:

    a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
    b. Protect adjacent surfaces from contact with cleaner.
    c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
    d. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
    e. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
    f. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

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

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
2. Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 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. Wood cabinets with plastic laminate.
   2. Plastic-laminate countertops.

B. Related Sections include the following:
   1. Division 8 Section "Flush Wood Doors."

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. Product Data: For medium-density fiberboard, plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for computer cord access, telephone and other cord access points and other items installed in architectural woodwork. Coordinate with Owner prior to completion of work.
   4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

   1. Shop-applied finishes.
   2. Plastic laminates.

D. Samples for Verification: For the following:

1. Plastic-laminate-clad panel products, 6 by 6 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
2. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 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 with sequence-matched wood veneers including wood doors where veneer matching includes door faces.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.

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. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and will 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.

C. 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.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by a firm that has completed business activities within the local area for a period of not less than five years. Firm must have completed work to match type and scope of this project. At time of product submissions submit past work experience for consideration of Architect and Owner.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI 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. Medium-Density Fiberboard: ANSI A208.2, Grade MD
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. 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.

c. Pionite

D. Adhesive for Bonding Plastic Laminate: Contact cement. Use only water based cement varieties to limit VOC.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing where noted as such.

D. Wire Pulls: Back mounted, 5 inches (100 mm) long, 5/16 inches (8 mm) in diameter.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

F. Door Locks: BHMA A156.11, E07121.

G. Drawer Locks: BHMA A156.11, E07041.

H. Shelf Rests: BHMA A156.9, B04013.

I. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Box Drawer Slides: 100 lbf. Indicate on submission that the submitted slides will meet this requirement.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 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.

2.5 FABRICATION, GENERAL

A. 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).
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

B. Complete fabrication, including assembly, finishing, and hardware application, 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. 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.

C. 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.

2.6 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

B. Grade: Custom.

C. WIC Construction Style: Style A, Frameless.

D. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together.

E. AWI Type of Cabinet Construction: Reveal overlay.

F. Reveal Dimension: 1/8 inch.

G. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: **HGS**.
2. Postformed Surfaces: **HGP**.
3. Vertical Surfaces: **HGS**

H. Edges: Plastic Laminate, match drawer faces

I. Materials for Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative overlay or as indicated on drawings.
2. Drawer Sides and Backs: Thermoset decorative overlay or as indicated on drawings.
3. Drawer Bottoms: Thermoset decorative overlay or as indicated on drawings.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. Plastic Laminate at cabinets:

K. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGP.

D. Edge Treatment: As indicated.

E. Core Material: Medium-density fiberboard – No urea-formaldahydes permitted. Provide submission information for this material and plywood.

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 AWI Section 1700 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. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips. No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

F. 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. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

G. 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.

H. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

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 07533 - THERMOPLASTIC SINGLE-PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Adhered sheet roofing.
2. Mechanically fastened sheet roofing.
3. Roof insulation.
4. 1/2" Denz Deck Prime

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, cants, and blocking; and wood-based, structural-use roof deck panels.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings and counterflashings.
3. Division 7 Section "Joint Sealants."

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. FM Listing: Provide sheet membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.

1. Roofing system shall comply with the following:

a. Fire/Windstorm Classification: Class 1A-120.

b. 100 mph wind

1.5 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Shop Drawings: Include plans, sections, and details of the following:

1. Base flashings and membrane terminations.

C. Samples for Verification: Of the following products:

1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
3. 6 insulation fasteners of each type, length, and finish.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of meeting requirements.

F. 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.

G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.

H. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

I. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

J. Warranty: As per DFCM's warranty requirements.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or an-

other testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and slopes indicated.

C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the preinstallation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

D. Preinstallation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Notify participants at least 5 working days before conference.

1. Meet with Owner; Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review loading limitations of deck during and after roofing.
5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
6. Review temporary protection requirements for roofing system during and after installation.
7. Review roof observation and repair procedures after roofing installation.
8. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid materials from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

1. Warranty requirements:

a. Minimum general contractors workmanship 5 year warranty period as per DFCM contractors warranty at the end of this section.
b. Minimum 20 year manufacturers roofing system warranty as per DFCM warranty at the end of this section

2. See D.F.C.M. warranty at end of specification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PVC Sheet:

a. Firestone Roofing.
b. Carlisle Corp.
c. Sarnafil Inc.

2. Polyisocyanurate Board Insulation:

a. Apache Products Co.
b. Atlas Roofing Corporation.
c. Celotex Corp. (The).
d. GAF Materials Corp.
e. NRG Barriers, Inc.

2.2 PVC SHEET

A. PVC Sheet: Uniform, flexible sheet formed from polyvinyl chloride with plasticizers and modifiers, complying with ASTM D 4434, of the following type, grade, thickness, and exposed face color:

1. Type: fabric-reinforced sheet.
2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White.
4. Maximum PVC sheet width 8'-0"

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing material.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, thickness, and color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, seam calk, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

2.4 THERMAL BARRIER

A. Thermal Barrier: a. Product: Subject to compliance with requirements, provide 5/8" "Denz Deck Prime", manufactured by Georgia-Pacific Corp.
1. Thickness: 1/2" inch (12.7 mm), unless otherwise indicated.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening thermal barrier to substrate.

2.5 INSULATION MATERIALS

A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C 1289, classified by facer type as follows:

1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.
2. Max thickness per sheet 2"

2.6 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Fasteners: Fasteners shall not extend through thickness of existing wood roof deck system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced.

C. Verify that wood nailers are in place and secured and match thicknesses of insulation required.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging conductors and from spilling or migrating onto surfaces of other construction.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 THERMAL BARRIER

A. Install thermal barrier with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt thermal-barrier boards together.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Attached Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type indicated.

H. Install denz deck over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck according to roofing system manufacturer's written instructions.

3.5 ADHERED SHEET INSTALLATION

A. Install thermoplastic sheet over area to receive roofing according to roofing system manufacturer's written instructions. Unroll sheet and allow to relax for a minimum of 30 minutes.

1. Install sheet according to ASTM D 5036.

B. Start installation of sheet in presence of roofing system manufacturer's technical personnel.

C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Apply bonding adhesive to substrate and underside of sheet at rate required by manufacturer and allow to partially dry. Do not apply bonding adhesive to seam area of sheet.

E. Apply a solid mopping of hot roofing asphalt, at a rate required by roofing system manufacturer, to substrate and install fabric-backed sheet. Keep seam area and remainder of sheet free of asphalt.

F. Mechanically fasten sheet securely at terminations and perimeter of roofing.

G. Apply roofing sheet with side laps shingled with slope of roof deck where possible.

H. Spread sealant bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring.

I. Install adhered thermoplastic sheet and auxiliary materials to tie in to existing roofing.

3.6 SEAM INSTALLATION

A. Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instructions to ensure a watertight seam installation. Weld seam as follows:

1. Weld Method: Hot air.

B. Test lap edges with probe to verify seam weld continuity. Apply seam calk to seal cut edges of sheet membrane.

C. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

3.7 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrate according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing as recommended by manufacturer.

D. Clean seam areas, overlap sheets, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Test lap edges with probe to verify seam weld continuity. Apply lap sealant and seal exposed edges of sheet flashing terminations.

3.8 FIELD QUALITY CONTROL

A. Verify field strength of seams a minimum of twice daily, according to manufacturer's written instructions, and repair seam sample areas.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

3.9 PROTECTING AND CLEANING

A. Protect sheet membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures required by manufacturer of affected construction.

END OF SECTION 07533

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 sheet metal flashing and trim in the following categories:

1. Exposed trim and fasciae.
2. Copings.
3. Metal flashing.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for elastomeric 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.

B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:

1. Wind Zone 3: Wind pressures of 46 to 104 psf (2.20 to 4.98 kPa).

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

D. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.

1. 6-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.
2. 6-inch- (300-mm-) long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

E. 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. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Construct mockups for the following type of sheet metal flashing and trim:

    a. Exposed trim and fasciae.
    b. Copings.

5. Obtain Architect's approval of mockups before start of final unit of Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

    a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Galvanized Steel Sheet: ASTM A 526, G 90 (ASTM A 526M, Z 275), commercial quality, or ASTM A 527, G 90 (ASTM A 527M, Z 275), lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 24 gauge thick, unless otherwise indicated.

B. Coil-Coated-Color Clad Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 24 gauge thick, unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Burning Rod for Lead: Same composition as lead sheet.

B. Solder: ASTM B 32, Grade Sn50, used with rosin flux.

C. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

G. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

H. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

I. Paper Slip Sheet: 5-lb/square (0.244 kg/sq. m) red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

J. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- (0.15-mm-) thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

K. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

L. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

F. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

G. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

C. Exposed Trim and Fasciae: Fabricate from the following material:

1. Anodized aluminum sheets: 18 gauge.

D. Copings: Fabricate from the following material:

1. Color Clad Coil-Coated Galvanized Steel: 24 gauge.

E. Base Flashing: Fabricate from the following material:

1. Color Clad Coil-Coated Galvanized Steel: 24 gauge.

F. Counterflashing: Fabricate from the following material:

1. Color Clad Coil-Coated Galvanized Steel: 24 gauge.

G. Flashing Receivers: Fabricate from the following material:

1. Color Clad Coil-Coated Galvanized Steel: 24 gauge.

H. PVC Coated Flashing Receivers: Fabricate from the following material:

1. PVC Coated Galvanized Steel: 24 gauge.

2.5 COIL-COATED GALVANIZED STEEL SHEET FINISH

A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
   a. Color and Gloss: As indicated on drawings, to match existing Coping colors
   b. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:

      1) Ausimont USA, Inc. (Hylar 5000)

2. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
3. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Atas Aluminum Corporation.
   b. Copper Sales, Inc.
   c. MM Systems Corporation.
   d. Petersen Aluminum Corporation.
   e. Vincent Metals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of

metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.

D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

E. 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 the following metals:

a. Aluminum.
b. Coil-coated galvanized steel sheet.

2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
1. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

I. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in receivers. Secure in a waterproof manner by means of snap-in installation and sealant, interlocking folded seam. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

J. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07620

SECTION 07920 - JOINT SEALANTS

1.1 GENERAL

A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.

B. Submittals: In addition to Product Data, submit the following:

1. Samples of each type and color of joint sealant required.
2. Test reports for joint sealants evidencing compliance with requirements.

1.2 PRODUCTS

A. Elastomeric Sealant Manufacturers: Subject to compliance with requirements, provide sealants by one of the following:

1. Silicone Sealants:

a. Bostik Inc.
b. Dow Corning.
c. NUCO Industries, Inc.
d. Polymeric Systems, Inc.
e. Sonneborn Building Products Div., ChemRex Inc.
f. Tremco.

2. Urethane Sealants:

a. W.R. Meadows, Inc.
b. Pacific Polymers, Inc.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Sonneborn Building Products Div., ChemRex Inc.
f. Tremco.

B. 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 testing and field experience.

C. Colors: Provide colors indicated for exposed joint sealants or, if not indicated, as selected by Architect from manufacturer's full range for this characteristic.

D. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant of base polymer specified below:

1. Medium-Modulus Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; with the additional capability, when tested per ASTM C 719, to withstand 50 percent movement in both extension and compression for a total of 100 percent movement and still comply with other requirements of ASTM C 920; and as follows:

a. Uses NT, M, G, A, and O.

2. Single-Component Nonsag Urethane Sealant: Type S; Grade NS; and as follows:

a. Class 12-1/2.
b. Class 25.
c. Uses NT, M, G, A, and O.
d. Uses NT, M, A, and O.

E. Latex Sealant: ASTM C 834.

F. Sealant Backings, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

G. 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.

H. 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).

I. 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.

J. Primer: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

1.3 EXECUTION

A. General: Comply with joint sealant manufacturer's instructions for products and applications indicated.

B. Sealant Installation Standard: Comply with ASTM C 1193.

END OF SECTION 07920

SECTION 08110 - STEEL DOOR 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 steel doors and frames.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Flush Wood Doors" for solid-core wood doors installed in steel frames.
2. Division 8 Section "Door Hardware" for door hardware.
3. Division 9 Section "Gypsum Board Assemblies"
4. Division 9 Section "Painting" .

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in 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. Steel Door Frames:

a. Amweld Building Products, Inc.
b. Benchmark Commercial Doors.
c. Ceco Door Products.
d. Copco Door Co.
e. Curries Co.
f. Deansteel Manufacturing Co.
g. Fenestra Corp.
h. Kewanee Corp.
i. Mesker Door, Inc.
j. Pioneer Industries.
k. Republic Builders Products.
l. Steelcraft.

2.2 MATERIALS

A. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.

B. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.

C. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch- (1.2-mm-) thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners.

B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

C. Plaster Guards: Provide minimum 0.0179-inch- (0.45-mm-) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.4 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

1. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

B. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

C. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.

D. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

E. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

2.6 STEEL SHEET FINISHES

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

B. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.

3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with the following standard:

1. NWWDA Quality Standard: NWWDA I.S.1-A, "Architectural Wood Flush Doors."
2. AWI Quality Standard: AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

1. Individually package doors in plastic bags or cardboard cartons.
2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.6 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addi-

tion to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not comply with tolerances in referenced quality standard.

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 after the date of Substantial Completion:
   a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:

   a. Algoma Hardwoods Inc.
   b. Ampco Products, Inc.
   c. Buell Door Co.
   d. Chappell Door Co.
   e. Eagle Plywood & Door Manufacturing, Inc.
   f. Eggers Industries; Architectural Door Division.
   g. Graham Manufacturing Corp.
   h. Mohawk Flush Doors, Inc.
   i. Oshkosh Architectural Door Co.
   j. Weyerhaeuser Co.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish: Comply with the following requirements:

1. Grade: Premium (Grade A faces).
2. Faces: match existing finish and species (White Birch Clear Finish)
3. Match within Door Faces: Center balance match.
4. Stiles: Applied wood edges of same species as faces and covering edges of faces.
5. Finish: Natural, clear

2.3 SOLID-CORE DOORS

A. Interior Veneer-Faced Doors: Comply with the following requirements:
   1. Core: Nonglued- or glued-block core.
   2. Construction: Seven plies.

2.4 FABRICATION

A. Fabricate flush wood doors in sizes indicated for Project site fitting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

C. Job-Fit 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 (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.

D. Field-Finished Doors: Refer to the following for finishing requirements:

1. Division 9 Section "Painting."

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08211

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior entrance systems.
2. Exterior storefront systems.

B. Related sections include the following:

1. Division 7 Section "Joint Sealants" for joint sealants installed as part of aluminum entrance and storefront systems.
2. Division 8 Section "Glazing."

1.3 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

D. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
b. Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.

E. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

F. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch (3.18-mm) clearance between members and top of glazing or other fixed part immediately below.
2. Provide a minimum 1/16-inch (1.59-mm) clearance between members and operable windows and doors.

G. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

H. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

I. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa). Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

J. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

K. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

L. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

M. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F (3.57 W/sq. m x K) when tested according to AAMA 1503.1.

N. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations. See specification section 08711 for door hardware.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

F. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

G. Field Test Reports: Indicate and interpret test results for compliance with storefront systems' performance requirements.

H. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

C. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Adhesive sealant failures.
3. Cohesive sealant failures.
4. Failure of system to meet performance requirements.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Failure of operating components to function normally.
7. Water leakage through fixed glazing and frame areas.

C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Butler Manufacturing Company; Vistawall Architectural Products.
2. International Aluminum Corporation; U.S. Aluminum.
3. Kawneer Company, Inc.
4. Tubelite Architectural Systems.
5. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glazing as specified in Division 8 Section "Glazing."

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

F. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.3 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch- (44.5-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
2. Stile Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

D. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.
2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.4 HARDWARE

A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated. See specification section 08711 for door hardware to be used at aluminum store front doors.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Fabricate components for shear-block frame construction.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

1. Color: **Anodized Dark Bronze**

2.7 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for

this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
2. Install structural silicone sealant according to sealant manufacturer's written instructions.
3. Mechanically fasten glazing in place until structural sealant is cured.
4. Remove excess sealant from component surfaces before sealant has cured.

H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

I. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08410

Weber State University
New Information Booth
Division of Facilities Construction Management

SECTION 08710--FINISH HARDWARE

PART 1 --GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. Extent of finish hardware required is indicated on drawings and in schedules.

C. Types of finish hardware required include the following:

Butt Hinges
Lock and latch sets
Door trim units

1.3 RELATED SECTIONS

A. Division 8 - Steel Door Frames.
B. Division 8 - Flush Wood Doors.

1.4 QUALITY ASSURANCE

A. Manufacturer: Obtain each type of hardware (latch and locksets, etc.) from a single manufacturer

B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced Architectural Hardware Consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.

C. This supplier shall be responsible to field check existing openings for proper application of sizes and strikes for all openings.

1.5 REGULATORY REQUIREMENTS

A. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibilities Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards."

1.6 SUBMITTALS

A. Product Data: Submit manufacturers technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit final hardware schedule in a vertical format as recognized by the Door and Hardware Institute (DHI). Horizontal schedule format will not be accepted. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.

1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Index to include location of hardware set cross-referenced to indications on drawings both on floor plans and in door and frame schedule.
e. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.

C. Submittal Sequence: Submit schedule in accordance to Division 1, particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

D. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

E. Samples if Requested: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finish as required, and tagged with full description for coordination with schedule. Return to project in time for installation.

F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.7 PRODUCT HANDLING

A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

D. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2—PRODUCTS

2.1 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following.

B. Manufacturer's Product Designations:

Butt Hinges:	Ives
Locksets:	Match Existing
Kickplates:	Ives
Floor/Wall Stops:	Ives

2.2 MATERIALS AND FABRICATION

A. General:

1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
3. Manufacturer's identification will be permitted on rim of lock cylinders only.
4. Finish: All hardware finish shall match existing unless otherwise indicated. Closer bodies, covers and arms shall be powder-coated finishes.
5. Lockset Design: Lever handle design shall match existing.
6. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
7. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
8. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.
9. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 HINGES, BUTTS AND PIVOTS

A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

A. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Steel Hinges: Steel pins.
2. Non-ferrous Hinges: Stainless steel pins.
3. Out-swing Corridor Doors: Non-removable pins.
4. Interior Doors: Non-rising pins.
5. Tips: Flat button and matching plug, finished to match leaves.
6. Number of hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

B. Furnish hinges in sizes and types as required by architect's details to achieve maximum degree of opening.

E. Acceptable Manufacturers:

1. Ives
2. McKinney
3. Hager

2.4 LOCK CYLINDERS AND KEYING

A. General: Supplier will meet with Owner to finalize keying requirements and obtain final instructions in writing.

B. Review the keying system with the Owner and provide a master, grandmaster or great-grandmaster integrated with Owner's existing system. If key pinning charts are required, owner to furnish charts to hardware supplier.

C. Furnish temporary keyed cores for the construction period, and remove these when directed. The construction cores remain property of the supplier and shall be returned to the supplier when they are removed. Contractor shall install the permanent cores in the presence of the owner's representative.

D. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

E. Permanently inscribe each key and cylinder with Visual Key Control that identifies cylinder manufacturer key symbol, and inscribe key with the notation "DO NOT DUPLICATE".

F. Key Material: Provide keys of nickel silver only.

G. Key Quantity:

1. Two extra blank for each lock.

I. Deliver keys to Owner's representative.

2.5 LOCKS, LATCHES AND BOLTS

A. Locks shall meet these certifications:

1. Cylindrical Locks - ANSI A156.2 Series 4000, Grade 1 Strength and Operational requirements. Meets A117.1 Accessibility Codes. Latch bolts shall be steel with minimum ½" throw, deadlocking on keyed and exterior functions.. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame. Locksets to be tested to exceed 3,000,000 cycles. Lock case shall be steel. Lock shall incorporate one piece spring cage and spindle. Provide 5/8" minimum throw of latch and deadbolt used on pairs of doors. Provide Seven Year Warranty.

   a. Lock design shall match existing.

B. Lock Manufacturers:

   1. Match existing

E. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

2.6 DOOR TRIM UNITS

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screws.

B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.

E. Metal Plates: Stainless steel, .050" (U.S. 18 ga.).

F. Acceptable Manufacturers:

1. Ives
2. Rockwood
3. Quality

2.7 DOOR SILENCERS

All hollow metal frames shall have grey resilient type silencers. Quantity (3) on single doors and quantity (2) on pairs of doors.

PART 3--EXECUTION

3.1 INSTALLATION

A. Hardware specified under this section for aluminum doors will be coordinated and delivered in a timely manner to aluminum door manufacturer for installation on aluminum doors prior to delivery to project. This coordination will not impede delivery of storefront or securing exterior of building during construction.

B. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.2 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

1.3 HARDWARE SCHEDULE

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

1.1 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grid Suspension Assemblies:

a. Armstrong World Industries, Inc.
b. Chicago Metallic Corp.
c. USG Interiors, Inc.
d. Worthington Steel Company (formerly National Rolling Mills).

2. Gypsum Board and Related Products:

a. Domtar Gypsum.
b. Georgia-Pacific Corp.
c. National Gypsum Co.; Gold Bond Building Products Division.
d. United States Gypsum Co.

B. Steel Framing Components for Suspended and Furred Ceilings: Provide components complying with ASTM C 754 for conditions indicated.

1. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.
2. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive paint.
3. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.
4. Channels: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base metal and 7/16-inch- (11.1-mm-) wide flanges, and as follows:
   a. Carrying Channels: 1-1/2 inches (38.1 mm) deep, 475 lb/1000 feet (70 kg/100 m), unless otherwise indicated.
   b. Furring Channels: 3/4 inch (19.1 mm) deep, 300 lb/1000 feet (45 kg/100 m), unless otherwise indicated.
   c. Finish: ASTM A 653, G 60 (ASTM A 653M, Z 180) hot-dip galvanized coating for framing for exterior soffits and where indicated.

C. Gypsum Board Products: Types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Gypsum Wallboard: ASTM C 36, in thickness indicated.

a.
b. Type: Type X
c. Type: Sag-resistant type for ceiling surfaces.
d. Edges: Tapered and featured (rounded or beveled) for prefilling.
e. Proprietary Gypsum Board Products: Subject to compliance with requirements, provide one of the following products where proprietary gypsum wallboard is indicated:

1) Gyprock Fireguard C Gypsum Board; Domtar Gypsum.
2) Firestop Type C; Georgia-Pacific Corp.
3) Fire-Shield G; National Gypsum Co.; Gold Bond Building Products Division.

4) SHEETROCK Brand Gypsum Panels, FIRECODE C Core; United States Gypsum Co.
5) SHEETROCK Brand Gypsum Panels, ULTRACODE Core; United States Gypsum Co.

2. Exterior Gypsum Soffit Board: ASTM C 931, with manufacturer's standard edges, in thickness indicated.

a. Type: Type X

D. Cementitious Backer Units: ANSI A118.9, in maximum lengths available to minimize end-to-end butt joints.

E. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed metal or plastic, with metal complying with the following requirement:

1. Steel sheet zinc coated by hot-dip process or rolled zinc.

F. Accessories for Exterior Installations: Cornerbead, edge trim, and control joints formed from steel sheet zinc coated by hot-dip process or rolled zinc complying with ASTM C 1047.

G. Joint Treatment Materials: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

1. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

2. Joint Tape for Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.

3. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

a. Ready-Mixed Formulation: Factory-mixed product.
b. Job-Mixed Formulation: Powder product for mixing with water at Project site.

1) Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
2) Topping compound formulated for fill (second) and finish (third) coats.
3) All-purpose compound formulated for both taping and topping compounds.

4. Joint Compound for Cementitious Backer Units: Material recommended by cementitious backer unit manufacturer.

H. Miscellaneous Materials: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
1. Fastening Adhesive for Wood: ASTM C 557.
2. Steel drill screws complying with ASTM C 1002 for the following applications:
a. Fastening gypsum board to wood members.
3. Steel drill screws of size and type recommended by unit manufacturer for fastening cementitious backer units.
4. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

5. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit stud size indicated.
6. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation to comply with ASTM C 665 for Type I.
7. Thermal Insulation: Material indicated below, of thickness and width to fill voids formed by Z-furring members:

    a. Unfaced mineral-fiber blanket insulation to comply with ASTM C 665 for Type I.

8. Polyethylene Vapor Retarder: ASTM D 4397, thickness and maximum permeance rating as follows:
    a. 6 mils (0.15 mm), 0.13 perms (7.5 ng/Pa x s x sq. m).

9. Vapor Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

1.2 EXECUTION

A. Installing Steel Framing for Suspended and Furred Ceilings: As follows:

1. Sway-brace suspended steel framing with hangers used for support.
2. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.
3. 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.

B. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

1. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
2. 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.
3. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. 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.
4. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
5. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

    a. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

6. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.
7. Install cementitious backer units to comply with ANSI A108.11.
8. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

    a. Fasten with screws.

C. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered over supports. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations. Fasten with corrosion-resistant screws.

D. Installing Trim Accessories: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

1. Install cornerbead at external corners.
2. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

    a. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
    b. Install L-bead where edge trim can only be installed after gypsum panels are installed.
    c. Install U-bead where indicated.
    d. Install aluminum trim and other accessories where indicated.
    e. Install control joints at locations indicated.
    f. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

E. Finishing Gypsum Board Assemblies: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

1. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
2. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
3. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
4. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
    a. Level 4 for gypsum board surfaces, unless otherwise indicated.
5. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
6. Finish exterior gypsum soffit board using setting-type joint compounds to prefill joints and embed tape, and for first, fill (second), and finish (third) coats, with the last coat being a sandable product. Smooth each coat before joint compound hardens to minimize need for sanding. Sand between coats and after finish coat.

    a. Painting exterior gypsum soffit board after finish coat has dried is specified in another Division 9 Section.
7. Finish cementitious backer units to comply with unit manufacturer's directions.

END OF SECTION 09255

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. Ceramic mosaic tile.
2. Glazed wall tile.
3. Waterproof membrane for thin-set tile installations.
4. Cementitious backer units.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units installed in gypsum wallboard assemblies.

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. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

C. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

D. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Full-size units of each type of trim and accessory for each color required.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

G. 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 of architects and owners, and other information specified.

H. Tile Test Reports: Indicate and interpret test results for compliance of special-purpose tile with specified requirements.

I. Setting Material Test Reports: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. 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.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
1. Cementitious backer units.
2. Joint sealants.
3. Waterproofing.

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 of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with 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 completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are 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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the ceramic tile installation schedules at the end of this Section.

B. Products: Subject to compliance with requirements, provide products indicated in the ceramic tile installation schedules at the end of this Section.

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

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Tile Products:
   a. Dal-Tile Corporation.
   b. Florida Tile Industries, Inc.
   c. Interceramics, USA.
   d. Mannington Ceramic Tile.

2. Tile-Setting and -Grouting Materials:

   a. American Olean Tile Company.
   b. Dal-Tile Corporation.
   c. DAP, Inc.

d. Mapei Corporation.

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 Materials" and "Grouting Materials" articles.

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:

1. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.

D. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

2.3 TILE PRODUCTS

A. Unglazed Ceramic Mosaic Tile: Provide factory-mounted flat tile complying with the following requirements:

1. Composition: Porcelain.
2. Module Size: As noted at end of specification section.

B. Glazed Ceramic Mosaic Tile: Provide factory-mounted flat tile complying with the following requirements:

1. Composition: Porcelain.
2. Module Size: As noted at end of specification section.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:

a. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.

2.4 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. Polyethylene-Sheet Waterproofing: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches (152 mm) wide by a nominal thickness of 6 mils, composed of an inner layer of non-plasticized, chlorinated polyethylene sheet faced on both sides with laminated, high-strength, nonwoven polyester material, designed for embedding in latex-portland cement mortar and as the substrate for latex-portland cement mortar setting bed.

2.5 SETTING MATERIALS

A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

1. Cleavage Membrane: polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.

2. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.

   a. Latex Additive: Manufacturer's standard.
   b. Latex Additive: Acrylic resin.

B. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

1. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

   a. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2. Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:

   a. Latex Additive: Acrylic resin.
   b. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

C. Organic Adhesive: ANSI A136.1, Type I.

2.6 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:

   a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.

2. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:

a. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch (3.2 mm) and narrower.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of 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 temperature extremes.

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

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

1. One-Part, Mildew-Resistant Silicone Sealants:

   a. Dow Corning 786; Dow Corning Corporation.
   b. Sanitary 1700; GE Silicones.
   c. Pecora 898 Sanitary Silicone Sealant; Pecora Corp.
   d. Rhodorsil 6B White; Rhone-Poulenc, Inc.
   e. Tremsil 600 White; Tremco, Inc.

2.8 CEMENTITIOUS BACKER UNITS

A. Provide cementitious backer units complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 5/8 inch (15.9 mm), where indicated.
2. Width: Manufacturer's standard width, but not less than 32 inches (813 mm).

B. Available Products: Subject to compliance with requirements, cementitious backer units that may be incorporated into the Work include, but are not limited to, the following:

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

1. The Original Wonderboard; Custom Building Products.
2. Wonderboard Multi÷Board; Custom Building Products.
3. DomCrete Cementitious Tile-Backer Board; Domtar Gypsum.
4. Util-A-Crete Concrete Backer Board; FinPan, Inc.
5. DUROCK Cement Board; United States Gypsum Co.

2.9 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. 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.

2.10 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.

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 from 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 latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in 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 adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:

1. Petroleum paraffin wax, applied hot.
2. Grout release.
3. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "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 a 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 the 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 the 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. Grout tile to comply with the 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.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor 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. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
1. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
2. Tile floors composed of rib-backed tiles.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Wall Tile: 1/16 inch (1.6 mm).

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

3.7 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 latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 CERAMIC TILE WALL INSTALLATION SCHEDULE

A. Ceramic Tile Wall Installation: Where interior wall installations is indicated, comply with the following:

B. Ceramic Tile Wall Installation: Where interior wall installations is indicated, comply with the following:

1. Tile Type/Products: Wall tile as follows.

a. Dal-tile or equal, Style: Continental Slate.
b. Style: Block Random
c. Color: As selected from full color range
d. Installation: TCA W244-03

D. GROUT FOR WALLS, Mapei or equal, provide sealer on all tile grout

3.9 CERAMIC MOSAICS UNGLAZED FLOOR TILE INSTALLATION SCHEDULE

A. Ceramic Floor Tile Installation: Where interior wall installations is indicated, comply with the following:

1. Tile Type/Products: Floor tile as follows.

a. Dal-tile or equal, Style: Continental Slate.
b. Style: Block Random
c. Color: As selected from full color range
d. Installation: TCA F113-03

E. GROUT FOR FLOOR, Mapei or equal, provide sealer on all tile grout.

END OF SECTION 09310

SECTION 09651 - RESILIENT TILE FLOORING

1.1 GENERAL

A. Submittals: As follows:

1. Product Data: For each type of product specified.
2. Samples: Of each different color and pattern of resilient product specified.
3. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

B. Extra Materials: Deliver extra materials to Owner as follows:

1. Furnish not less than one box for each color of resilient tile flooring installed.

1.2 PRODUCTS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Resilient Tile Flooring Schedule at the end of this Section.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Resilient Tile Flooring Schedule at the end of this Section.

C. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Resilient Tile Flooring Schedule.

D. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

E. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1.3 EXECUTION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

1. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Preparation: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

C. Tile Installation: Comply with tile manufacturer's written installation instructions.

1. 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 of a tile at perimeter.

   a. Lay tiles square with room axis.

2. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered.
   a. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles.
   b. Lay tiles in pattern of colors and sizes indicated on Drawings.

D. Resilient Accessory Installation: Install resilient accessories according to manufacturer's written installation instructions.

E. Clean and protect resilient products according to manufacturer's written recommendations. Clean resilient products after installation and not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project.

F. Tile Floor Schedule
1. Color #1 shall be Mannington Commerical "Essentials or equal"

2. Color #2 shall be Mannington Commerical "Essentials or equal"

3. Color #3 shall be Mannington Commerical "Essentials or equal"

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.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

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, those indicated in the Resilient Wall Base and Accessory Schedule at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Resilient Wall Base and Accessory Schedule at the end of Part 3.

2.2 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with resilient wall base and accessories section 3.5 of this specification section.

2.3 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements specified in the Resilient Wall Base and Accessory Schedule.

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. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
5. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

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.

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 to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

3.5 RESILIENT WALL BASE AND ACCESSORY SCHEDULE

A. Rubber Wall Base: Where designated, provide rubber wall base complying with the following:

1. Color and Pattern: Roppe 700 series or approved equal by others, color as selected by project manager to match existing building color.

2. Style: 4" Coved edge at VCT tile locations

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. 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. Finished mechanical and electrical equipment.
      b. Light fixtures.
      c. Distribution cabinets.
      d. Aluminum window frames and doors

   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.
      e. Pipe spaces.
      f. Duct shafts.

   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 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
2. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

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. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. 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, the Architect will furnish color chips for surfaces to be coated.

C. 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.
3. Submit Samples on the following substrates for the Architect's review of color and texture only:
   a. Stained or Natural Wood: Provide two 4-by-8-inch (100-by-200-mm) samples of natural- or stained-wood finish on actual wood surfaces.

D. 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.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Devoe & Raynolds Co. (Devoe).
2. Fuller-O'Brien Paints (Fuller).
3. Glidden Co. (The) (Glidden).
4. Benjamin Moore & Co. (Moore).
5. PPG Industries, Inc. (PPG).
6. Pratt & Lambert, Inc. (P & L).
7. Sherwin-Williams Co. (S-W).
8. Kwal-Howells
9. Others as pre-approved.

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.

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.

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. 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.

3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. 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. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   2. Provide finish coats that are compatible with primers used.
   3. 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.
   4. 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.
   5. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   7. 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. 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.

G. 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.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative material analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.
e. Washability.
f. Absorption.
g. Accelerated weathering.
h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from 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.

3.6 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.

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.

3.7 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces where designated by architect:

1. Low-Luster, 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) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
2) Fuller: 220-20 Pro-Tech Interior Latex Wall Primer and Sealer.
3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
4) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
5) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
6) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.
7) Kwal-Howells: 0880 Latex Sealer

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) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
2) Fuller: 212-XX AA Enamel Acrylic Latex Eggshell Enamel.
3) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall & Trim Paint.
4) Moore: Moore's Regal AquaVelvet #319.
5) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
6) P & L: Z/F 4000 Series Accolade Interior Velvet.
7) Kwal-Howells: 1902 Latex Low Sheen Enamel

2. 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) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
2) Fuller: 220-20 Pro-Tech Latex Wall Primer Sealer, White.

3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
4) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
5) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
6) P & L: Z/F 1001 Suprime "1" 100 Percent Acrylic Multi-Purpose Primer.
7) Kwal-Howells: 0880 Latex Sealer

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) Devoe: 39XX Wonder-Tones Semi-Gloss Interior Latex Enamel.
2) Fuller: 214-XX AA Enamel Interior Acrylic Latex Semi-Gloss Enamel.
3) Glidden: 8200 Series Spred Ultra Latex Semi-Gloss Enamel.
4) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.
5) PPG: 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex.
6) P & L: Z/F 4100 Series Accolade Interior Semi-Gloss.
7) Kwal-Howells: 2900 Acrylic Enamel

B. Natural-Finish Woodwork: Provide the following natural finishes over new, interior woodwork:

1. Waterborne, Satin-Varnish Finish: 2 finish coats of a waterborne, clear-satin varnish over a sanding sealer. Wipe wood filler before applying stain.

a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

1) Devoe: None required.
2) Moore: Benwood Paste Wood Filler #238.
3) PPG: None required.
4) P & L: None required.

b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

1) Devoe: 4200 WoodWorks Waterborne Quick-Dry Clear Sealer.
2) Moore: None recommended.
3) PPG: 77-30 Rez Interior Quick-Drying Sealer and Finish.
4) P & L: Z 7520 Latex Sanding Sealer.

c. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.

1) Devoe: 4300 WoodWorks Waterborne Crystal Clear Finish, Satin.
2) Moore: Stays Clear Acrylic Polyurethane #423, Satin.
3) PPG: 77-49 Rez Satin Acrylic Clear Polyurethane.
4) P & L: Z 17 Acrylic Latex Varnish, Satin.

C. Exterior Gypsum Soffit Board: Provide the following finish systems over exterior gypsum soffit board:

1. Low-Luster Acrylic Finish: 2 finish coats over a primer.

a. Primer: Exterior, alkyd- or alkali-resistant, acrylic-latex 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) Devoe: 1102 All-Weather Exterior Alkyd House Paint Primer.
2) Fuller: 220-17 Acrylic Concrete and Masonry Primer Sealer.
3) Glidden: Primer not required over this substrate.
4) Moore: Moore's Latex Exterior Primer #102.
5) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
6) P & L: S/D 1008 Suprime "8" Exterior Alkyd Wood Primer.

b. First and Second Coats: Low-luster (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 2.3 mils (0.058 mm).

1) Devoe: 16XX Wonder-Shield Exterior Acrylic Latex Satin House and Trim Paint.
2) Fuller: 261-XX Eggshell Sheen Latex House and Trim Paint.
3) Glidden: 6700 Series Spred Ultra Exterior Satin Latex House and Trim Paint.
4) Moore: MoorGard Latex House Paint #103.
5) PPG: 76 Line Sun-Proof Exterior House & Trim Acrylic Satin Latex.
6) P & L: Z/F 1800 Series Aqua-Shell Exterior Latex Eggshell Paint.

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Semigloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Galvanized metal 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) Devoe: 13201 Mirrolac Galvanized Metal Primer.
2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
3) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
4) Moore: IronClad Galvanized Metal Latex Primer #155.
5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
7) S-W: Galvite Paint B50W3.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, 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 1.2 mils (0.031 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: UH 8400 Series Spred Ultra Traditional Alkyd Semi-Gloss Enamel.
4) Moore: Moore's Alkyd Enamel Underbody #217.
5) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
6) P & L: S/D 1011 Suprime "11" Interior Alkyd Wood Primer.
7) S-W: ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.

c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).

1) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
2) Fuller: 110-XX Fullerglo Alkyd Semi-Gloss Enamel.
3) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.

4) Moore: Satin Impervo #235.
5) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
6) P & L: S/D 5700 Cellu-Tone Alkyd Satin Enamel.
7) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.

2. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Galvanized metal 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) Devoe: 13201 Mirrolac Galvanized Metal Primer.
2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
3) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
4) Moore: IronClad Galvanized Metal Latex Primer #155.
5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
7) S-W: Galvite Paint B50W3.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, 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 1.2 mils (0.031 mm).

1) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
3) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
4) Moore: Moore's Alkyd Enamel Underbody #217.
5) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
6) P & L: S/D 1001 Suprime "11" Interior Alkyd Wood Primer.
7) S-W: Industrial Enamel B-54 Series.

c. Finish Coat: Full-gloss, alkyd, interior enamel 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) Devoe: 70XX Mirrolac Interior/Exterior Alkyd-Urethane Gloss Enamel.
2) Fuller: 312-XX EPA Compliant Heavy-Duty Enamel.
3) Glidden: 4500 Series Glid-Guard Alkyd Industrial Enamel.
4) Moore: Impervo Enamel #133.
5) PPG: 54 Line Pittsburgh Paints Gloss-Oil Interior/Exterior Enamel.
6) P & L: S/D 1100 Series Effecto Enamel.
7) S-W: Industrial Enamel B-54 Series.

END OF SECTION 09900

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:

    a. Portable fire extinguishers.

3. Fire-protection accessories.

B. Related Sections include the following:
1. Division 9 Section "Painting" for field-painting fire-protection cabinets.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

C. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Size: 6-by-6-inch- (150-by-150-mm-) square Samples.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for 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 extinguishers listed and labeled by FM.

1.5 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Portable Fire Extinguishers:

a. Amerex Corporation.
b. Ansul Incorporated.
c. Badger; Div. of Figgie Fire Protection Systems.
d. Buckeye Fire Equipment Company.
e. Fire-End & Croker Corporation.
f. General Fire Extinguisher Corporation.
g. J.L. Industries, Inc.
h. Kidde: Walter Kidde, The Fire Extinguisher Co.
i. Larsen's Manufacturing Company.
j. Modern Metal Products; Div. of Technico.
k. Moon/American, Inc.
l. Pem All; Div. of Pem Systems, Inc.
m. Potter-Roemer; Div. of Smith Industries, Inc.
n. Samson Products, Inc.
o. Watrous; Div. of American Specialties, Inc.

2. Fire-Protection Cabinets:

a. Filtrine Manufacturing Company.
b. Fire-End & Croker Corporation.
c. General Accessory Manufacturing Co.
d. J.L. Industries, Inc.
e. Larsen's Manufacturing Company.
f. Modern Metal Products; Div. of Technico.
g. Moon/American, Inc.
h. Potter-Roemer; Div. of Smith Industries, Inc.
i. Samson Products, Inc.

j. Thomas Enterprises.
k. Watrous; Div. of American Specialties, Inc.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the Fire-Protection Cabinet Schedule at the end of Part 3.

D. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Fire-Protection Cabinet Schedule at the end of Part 3.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

C. Stainless-Steel Sheet: ASTM A 666/A 666M, Type 302 or Type 304 alloy.

D. Copper-Alloy Sheet, Brass: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).

E. Copper-Alloy Sheet, Bronze: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 20-lb (4.5-kg) nominal capacity, in enameled-steel container.

2.4 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.

a. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
b. Provide factory-drilled mounting holes.

2. Cabinet Metal: Enameled-steel sheet.
3. Shelf: Same metal and finish as cabinet.

B. Cabinet Type: Suitable for the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.

a. Provide recessed flange, of same material as box, attached to box to act as plaster stop.

2. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

a. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Manufacturer's standard, as follows:

1. Steel sheet.

F. Door Material: Manufacturer's standard, as follows:

1. Steel sheet.

G. Door Glazing: Manufacturer's standard, as follows:

1. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, as follows:
   a. Thickness: 6 mm.

2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:

a. Class 1 (clear).

3. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm.

H. Door Style: Manufacturer's standard design, as follows:

1. Fully glazed panel with frame.

I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
2. Provide inside latch and lock for break-glass panels.

J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers not located in cabinets.
2. Provide brackets for extinguishers located in cabinets.

B. Break-Glass Strike: Provide manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.

C. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

D. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
   a. Application Process: Decals.
   b. Lettering Color: White.
   c. Orientation: Vertical.

2.6 COLORS AND TEXTURES

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

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying 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. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:

1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
2. Interior of cabinets and doors.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure and cabinets, square and plumb.
3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10520

SECTION 10801 - TOILET AND BATH ACCESSORIES

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following:

Toilet and bath accessories.

SUBMITTALS

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.

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.

Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

QUALITY ASSURANCE

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.

COORDINATION

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.

WARRANTY

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.

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.

Minimum Warranty Period: 15 years from date of Substantial Completion.

PRODUCTS

MANUFACTURERS

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:

Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:

Toilet and Bath Accessories: See specified accessories alternate must meet specified quality and construction. Pre-approval by architect prior to bidding.

A & J Washroom Accessories, Inc.
American Specialties, Inc.
Bobrick Washroom Equipment, Inc.
Bradley Corporation.
McKinney/Parker Washroom Accessories Corp.

Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Toilet and Bath Accessory Schedule at the end of Part 3.

MATERIALS

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.

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.

Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

FABRICATION

General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

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.

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.

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.

Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of three keys to Owner.

EXECUTION

INSTALLATION

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. Provide blocking in walls as needed for sufficient installation Toilet and Bath accessories.

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.

Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

ADJUSTING AND CLEANING

Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

Remove temporary labels and protective coatings.

Clean and polish exposed surfaces according to manufacturers written recommendations.

TOILET AND BATH ACCESSORY SCHEDULE:

1. Paper Towel Dispenser: Bobrick B-4262 stainless steel satin finish, or pre-approved equal by others.
2. Surface Mounted Multi-Roll Toilet Tissue Dispenser: Bobrick B-4288 stainless steel satin finish, or pre-approved equal by others.
3. Surface Mounted Toilet Seat Cover Dispenser: Bobrick B-4221 stainless steel satin finish, or pre-approved equal by others.
4. Surface Mounted Soap Dispenser: Bobrick B-4112 or pre-approved equal by others by others.
5. Grab Bar, Bobrick B-5806 or approved equal, stainless steel grab bar with snap flange 1 @ 36" long , 1 at 30" long 1 at 18" long and at handicap stall or per approved equal by others.

Mirror Unit, provide mirror unit complying with the following:
Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.

END OF SECTION 10801

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SECTION 15000 - GENERAL MECHANICAL REQUIREMENTS

PART I - 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 work of this section.

B. Related Sections: Refer to "Electrical Requirements for Mechanical Equipment" Section in Division 15 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section.

1.2 SUMMARY: This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 15000. It expands and supplements the requirements of Division 1.

This Division does not define, nor is it limited by, trade jurisdictions. All work described herein is a part of the General Contract and is required of the Contractor regardless.

1.3 DESCRIPTION OF PROJECT: The mechanical work described in these mechanical specifications is for a project located in Ogden, Utah. Design weather conditions are: 92° db, 62° wb, and winter 8°F. Altitude readings, unless otherwise noted, are for an elevation of 4,500 feet above sea level. Make adjustment to manufacturer's performance data as needed.

1.4 CODES AND PERMITS, AUTHORITIES HAVING JURISDICTION:

A. Perform the mechanical work in strict accordance with the applicable provisions of the various codes ordinances and adoptions pertaining to the project location in effect on the date of invitation for bids. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications govern.

B. Hold and save the Owner and Engineer free and harmless from liability of any nature or kind arising from failure to comply with codes and ordinances.

C. Secure and pay for permits necessary for the prosecution of the work under this contract. Contractor to pay all fees and include connection fees related to utility hookups.

D. Reference Standards:

American Welding Society
International Mechanical Code/State Code
International Building Code/State Code
SMACNA Duct Design Standards
Local/State Plumbing Code
Locally enforced NFPA Codes
Local Fuel Utility Regulations
Local Power Utility Regulations
American Gas Association
ASME Codes for Pressure Vessels and Piping
ANSI B31.1 Piping

E. Final inspection by the Engineer will not be made nor Certificate of Substantial Completion issued until certificates of acceptability from the Authorities having jurisdiction are delivered.

1.5 DEFINITION OF PLANS AND SPECIFICATIONS: The mechanical drawings at reduced scale show the general arrangement of piping, ductwork, equipment, etc., and shall be followed as closely as the actual building construction and the work of other trades will permit. The Architectural and structural drawings shall be considered as part of the work insofar as these drawings furnish the Contractor with information relating to design and construction of the building. Architectural drawings shall take precedence over mechanical drawings. Request clarification and participate in resolution in the event of conflict.

Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and arrange the work accordingly, providing such extensions, fittings, valves and accessories to meet the conditions as may be required. Some small scale work is not shown such as control conduit and piping, incidental piping, specialties. Provide as directed by note or specification.

Examine the actual construction site prior to bidding and obtain an understanding of the conditions under which the work will be performed. No allowances will be made for failure to make such examination.

During construction, verify the dimensions governing the mechanical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings. Examine adjoining work on which mechanical work is dependent for perfect efficiency, and report any work of other trades which must be corrected. No waiver of responsibility for defective work shall be claimed nor allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

1.7 MECHANICAL INSTALLATIONS:

A. Coordinate mechanical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate installation of mechanical equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, existing structures and other installations.

J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

K. Where mechanical work penetrates other trade work such as gypboard walls, etc., penetration shall be neatly cut and walls shall be filled and patched.

1.8 ACCESSIBILITY:

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Extend all grease fittings to an accessible location.

C. Establish required clearance to all installation features involving operation and maintenance. Respect manufacturers recommendations for access and clearance.

D. Access Doors - General: All items of mechanical equipment which may require adjustment, maintenance, replacement or which control a system function shall be made readily accessible to personnel operating the building.

1. Provide access doors in all ductwork or plenums as required to maintain fire dampers, fire smoke dampers, equipment, controls or other elements of the system. Doors shall conform to SMACNA standards unless otherwise detailed or specified.

2. Provide access doors in floors, walls, ceiling and partitions to valves, cleanouts, chases, dampers, etc., and to access doors in ductwork requiring the same. Access doors shall be all-steel construction equivalent to "Milcor" by Inland Ryerson in a style approved by the Owner's Representative. Doors shall be 24" x 24", or as needed, with screwdriver latches.

1.9 CHANGE ORDERS: See General Conditions.

1.10 ALTERNATIVE CONSTRUCTION/SUBSTITUTION: These documents outline a way in which the Owner may be delivered a functional and reliable facility. Drawings and specifications describe reasonable engineering practice for the Contractor to follow.

Coordination between trades may result in periodic needs to adjust the installation from that indicated, but in no case shall the intended function be compromised.

The Contractor may perceive some work methods which differ from those specified which could save time and effort. These may be presented to the Engineer with a breakdown of possible cost savings for review. Implement only with authorization.

Materials substitutions will generally be covered in a review process prior to bidding. After bidding, substitutions shall be proposed only on the basis of definitive cost accounting and implemented only with authorization.

1.11 CUTTING AND PATCHING:

A. Lay out the project where new work is involved ahead of time, providing sleeves and blockouts, and have work specifically formed, poured and framed to accommodate mechanical installations. Cut and patch only as needed.

B. Refer to the Division 1 Section: CUTTING AND PATCHING for general requirements for cutting and patching.

C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other and any work damaged as a result of mechanical installations.

E. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work;

2. Remove and replace defective Work;

3. Remove and replace Work not conforming to requirements of the Contract Documents;

4. Remove samples of installed Work as specified for testing;

5. Install equipment and materials in existing structures.

G. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.

H. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping and other mechanical items made obsolete by the new Work.

I. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

J. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1.12 SUBMITTALS: Submittal of shop drawings, product data, and samples will be accepted only from the Contractor to the Engineer. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed. Document each transmittal and sign and stamp the submittal indicating that it has been reviewed and is in compliance with the criteria of the project, any exceptions being clearly noted.

A. Shop Drawings: As soon as possible after the contract is awarded, submit to the Engineer, seven (7) copies of the descriptive literature covering all equipment and materials to be used in the installation of mechanical systems for this project. Written confirmation of acceptable review by the Owner's Representative shall be obtained before ordering, purchasing, acquiring or installing any such equipment or materials for the project.

Prepare the submittals in an orderly manner after the order of this specification, contained in a three-ring loose leaf binder(s) with identification tabs for each item or group of related items. Submitted literature shall clearly indicate performance, quality, utility requirements, dimensions of size, connection points and other information pertinent to effective review.

Equipment must fit into the available space with allowance for operation, maintenance, etc. The Contractor shall take full responsibility for space and utility requirements for equipment installed.

Factory-wired equipment shall include shop drawings of all internal wiring to be furnished with unit.

Review of the Engineer is for general conformance of the submitted equipment of the project specification; in no way does such approval relieve Contractor of his obligation to furnish equipment and materials that comply in detail to the specification, nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions which may affect his work.

B. Record Drawings: During the course of construction, maintain a set of drawings, specifications, change orders, shop drawings, addenda, etc., for reference and upon which all deviations from the original layout are recorded. Turn these marked-up documents over to the Engineer at the conclusion of the work so that the original tracings can be revised. If the Contractor fails to mark up the prints, reimburse the Engineer for time required to do so.

1.13 OPERATION AND MAINTENANCE TRAINING:

A. Instruction Of Owner's Personnel: At a time prior to Owner making use of a device or system, and in general after work for a building or major system is complete, prepare, schedule and conduct a series of training sessions for Owner's operating and supervisory personnel. Instructions shall cover each device and system with emphasis on understanding of the purpose and function, the maintenance requirements and the proper adjustment and operating technique.

B. Minimum instruction periods shall be as follows:

1. Mechanical - one hour total to review operation of heat tracing system.

1.14 GUARANTEE/WARRANTY: The following guarantee is a part of this specification and is binding on the part of the Contractor and his assigns:

"Contractor guarantees that this installation is in accordance with the terms of the Contract and is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance. See also the General Conditions of these specifications. Failed equipment in the repair or replacement shall be guaranteed for one full year from the date of recommission."

Compile and assemble the warranties required by Division 15 into a separated set of vinyl covered, insert sheets, tabulated and indexed for each reference, included in the O & M Manual.

Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

Mechanical systems and equipment shall not be considered for substantial completion and initiation of warranty until they have performed in service continuously without malfunction for at least thirty (30) working days.

1.15 TESTS AND CERTIFICATIONS: Make all tests required by code or specification in the presence of a representative of the Owner, with tests recorded and certified by the Contractor and Representative. Involve local authorities where required.

1.16 PERMITS, FEES, LICENSES: Refer to General Conditions. See Paragraph 1.04.

1.17 SCHEDULING/METHODS OF PROCEDURE: Where interruptions of service are needed to effect work of this contract, outline the work, coordinate with other trades, determine the Owners acceptable downtime and prepare a time based schedule to accomplish the work. Give notice of a necessary utility interruption (or shutdown) to any existing system to the owner's construction coordinator not less than 72 hours prior to the proposed shutdown.

PART II - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 QUALITY OF MATERIALS AND EQUIPMENT:

A. All equipment and materials shall be new, and shall be the standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment, and shall be the manufacturer's latest design. Specific equipment shown in schedules on drawings and specified herein is to be the basis for the Contractor's bid. Provisions for substitute equipment are outlined in the General Conditions. All materials shall be produced by manufacturing plants located in the United States of America.

B. Furnish and install all major items of equipment specified in the equipment schedules on the drawings complete with all accessories normally supplied with catalog items listed, and all other accessories necessary for a complete and satisfactory installation.

2.2 PROTECTION OF MATERIALS AND EQUIPMENT:

A. Close pipe and duct openings with caps or plugs to prevent lodgment of dirt or trash during the course of installation. Cover equipment tightly and protect against dirt, water and chemical or mechanical injury. Make damage and defects developing before acceptance of the work good at Contractor's expense.

B. Do not make temporary use of project equipment, new or existing, during construction without the consent of the owner.

2.3 QUALIFICATIONS OF WORKMEN:

A. All mechanics shall be capable journeymen, skilled in the work assigned to them. Apprentices may be used with appropriate direction.

B. Employ no unskilled persons in the work which he is given to do: execute all work in a skillful and workmanlike manner. All persons employed upon this work shall be competent, faithful, orderly and satisfactory to the Owner. Should the Owner's Representative deem anyone employed on the work incompetent or unfit for his duties, and so certify, Contractor shall dismiss him and he shall not be again employed upon the work without permission of the Owner's Representative.

C. All welders involved in welding of pressure piping systems shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Written verification of successful test completion shall be submitted to Engineer prior to initiating work.

2.4 FOREMAN: Dedicate and designate a full-time general mechanical foreman to the Owner's Representative to be consistently available on site during the life of the project for consultation. Do not replace this individual without prior approval from the Owner's Representative.

2.5 USE OF COMMON VENDORS: Regardless of subcontract delegations, coordinate purchasing between trades so that equipment and materials of similar nature come from a single vendor, i.e., all package HVAC terminal units shall be common source. Valves, variable volume boxes, speed drives, etc., the same. Do not burden the Owner with multiple brands of similar equipment unless so directed.

2.6 ROOF/WALL/FLOOR PENETRATIONS - FLASHINGS:

A. Install sleeves through the floor into "dry rooms" flush with the floor, caulked and sealed. Into wet rooms, extend piping to create 1" dam. Use Schedule 40 galvanized steel pipe for all pipe sleeves.

B. Let pipe sleeves allow for movement of the pipe due to expansion and contraction, yet to include seismic restraint.

C. Flashings:

1. Flash all pipes penetrating the roof. Provide required flashing components.

2. Flash and counterflash other piping penetrating the roof. See drawings or Engineer for additional detail.

2.7 HANGERS AND SUPPORTS (GENERAL):

A. Provide hangers and/or supports for all equipment, and piping. Primary information is contained in these specifications and on the drawings.

B. Provide hangers and supports to correlate with seismic restraint and vibration isolation.

2.8 MANUFACTURER'S DIRECTIONS: Install all equipment in strict accordance with directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, report such conflicts to the Engineer who shall direct adjustments as deemed necessary and desirable.

2.9 ELECTRICAL WIRING AND CONTROL:

A. In general, motor starters, related motor starter equipment and power wiring indicated on the electrical drawings and control diagrams are to be furnished and installed under Division 16000 of this Specification. Items of electrical control equipment specifically mentioned to be furnished by the Division 15000 either in these specifications or on the electrical or mechanical drawings, shall be furnished and mounted by this Contractor and shall be connected under and as required by this Division 15000 and Division 16000 of these specifications.

B. Refer to the control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the contractor.

C. Division must be fully coordinated with Division 16000 to insure that all required components of the work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of coordination.

D. Where the detailed electrical work is not shown on the electrical drawings, the Mechanical Contractor shall furnish, install and wire or have prewired all specified and necessary controls for air handling equipment specified for this project. The objective of this paragraph is to make sure a complete operating system is obtained at no additional cost to the Owner for field wiring required related to the equipment.

2.10 FLUSHING AND DRAINING OF SYSTEMS/CLEANING OF PIPING: Fill, clean and flush and sterilize where appropriate, all water piping systems with water and drain these systems before they are placed in operation. Blow out all other piping systems with compressed air or nitrogen to remove foreign materials that may have been left or deposited in the piping system during its erection.

2.11 JOBSITE CLEANUP:

A. Keep site clean during progress of work.

B. At the conclusion of work, clean all installation thoroughly.

1. Leave equipment in a factory dock condition. Correct any damage and touch up or repaint if necessary.

2. Remove all debris from site.

END OF SECTION 15000

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SECTION 15060 - GENERAL PIPES AND FITTINGS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is Division-15 General Pipes and Fittings section, and is part of each Division-15 section making reference to pipes and pipe fittings specified herein.

C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

A. This section is generic in that it describes material and installation required by several other sections of this specification.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Copper Piping
2. Miscellaneous Piping Materials/Products.

C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications:

1. Firm with at least three years history of successful experience on projects of similar nature.

2. Licensed as a firm in the contractor state of origin and in the State of Utah.

3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.

4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

B. Brazing Certifications: Submit reports as required for piping work.

C. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes And Standards:

1. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

2. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART II - PRODUCTS

2.1 GENERAL:

A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. Use United States (domestic) manufactured pipe only. Do not use foreign made pipe.

B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable. Use domestic manufactured fittings only. Do not use foreign manufactured fittings.

2.2 COPPER TUBE AND FITTINGS:

A. Copper Tube: ASTM B 88; Type K, L (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated. Do not use Type M for pressure piping.

B. DWV Copper Tube: ASTM B 306.

C. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

D. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

E. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.

F. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

G. Cast-Copper Flared Tube Fittings: ANSI B16.26.

H. Bronze Pipe Flanges/Fittings: ANSI B16.24.

I. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.3 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

A. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use **no lead** bearing solders in domestic water applications.

Tin-Antimony Solder: ASTM B 32, Grade 95TA.

Silver-Lead Solder: ASTM B 32, Grade 96TS.

B. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

PART III - EXECUTION

3.1 INSTALLATION:

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction

or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.

C. All piping in mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.

D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.

E. Arrange piping to maintain head room and keep passageways clear.

F. Provide unions at connections to equipment and elsewhere as required to facilitate maintenance.

G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.

H. Erect all piping to insure proper draining. Domestic water, chilled water, and heating water shall slope down a minimum of 1" per 40 feet towards the drains.

I. On horizontal straight runs of pipe, use eccentric reducers with straight side on top for water piping.

J. Electrical Equipment Spaces: Do not run piping in or through transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.

K. Anytime lines are broken or disconnected they shall be capped immediately after flushing. If rocks or other foreign materials are found in the system after it has been closed, the Contractor shall stand the expense of their removal.

3.2 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

C. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.

D. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

3.3 CLEANING, FLUSHING, INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

C. Flush, treat and clean heating and cooling systems in accordance with Sections chemical treatment. Certify by signature of Contractor and Owner's Representative.

3.4 PIPING TESTS:

A. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is 2 hours.

2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are lower Class or pressure rating.

3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.

4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Notifications: At least 10 days prior to commencement of required testing, notice shall be submitted for review. Tests shall be made prior to painting insulating or covering of any joints and shall be in accordance with ANSI Code for Pressure Piping.

C. Inspections: Contractor to visually inspect piping while under hydrostatic pressure. Copies of inspection shall be submitted for review. At option of contract, welds not hydrostatically tested may be x-ray tested.

D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Drain test water from piping systems after testing and repair work has been completed.

F. Test pressure piping in accordance with ANSI B31.

G. Test waste, drain and vent systems in accordance with local plumbing code and these specifications. Repair failed sections by disassembly and reinstallation.

H. If test procedures in other sections differ from the above, comply with more stringent requirements.

END OF SECTION 15060

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SECTION 15100 - VALVES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is Division-15 Valves section, and is part of each Division-15 section making reference to valves specified herein.

C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-15 sections.

B. Types of valves specified in section include the following:

1. Ball Valves.

C. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by same manufacturer.

C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".

2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.

PART II - PRODUCTS

2.1 VALVES:

A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. Operators: Provide hand wheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 5" and smaller.

D. Connections: Unless otherwise noted for a particular reason, any valve 3" and larger shall have flanges.

2.2 MANUFACTURERS: For all valves subject to compliance with requirements, provide valves of one of the following: Comply with specific manufacture requirements listed for specific valves.

A. Crane
B. Keystone
C. Powell
D. Nibco/Scott
E. Lunkenheimer
F. Stockham
G. Milwaukee
H. Bray
I. Apollo
J. Grinnell
K. Watts
L. Norris
M. Wallworth

All valves of a given type shall be of the same manufacturer.

2.3 DOMESTIC COLD/HOT WATER:

A. Ball Valves:

1. Steel piping 3" and Smaller: 400 psig WOG @ 350°F, bronze construction, threaded ends, bubble tight mineral filled PTFE seat at 250 psig under water, hard, chrome plated brass or stainless steel full ported ball. Operate with flow in either direction. Lever or tee hand as required. Suitable for throttling and tight shut-off. Watts B-6000, B-6001 for domestic water, Apollo 70-100, Crane Hydro Gem 2190H Milwaukee, Jamesbury, Stockham. No other manufacturers approved.

PART III - INSTALLATION

3.1 VALVE INSTALLATION:

A. Locate all valves in locations which will allow easy operation and facilitate maintenance.

B. Install valves with stems horizontal or above.

C. All branch lines which supply a specific area of the building (such as a toilet room) shall be valved near the main so that each area may be isolated from the system for repairs without having to shut down both men and women's restrooms, other areas, or the whole building.

D. Make all valves located above a non-lay-in type ceiling or behind a wall accessible by means of an access door.

END OF SECTION 15100

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SECTION 15140 - MECHANICAL SUPPORTING DEVICES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is Division-15 Mechanical Supporting Devices section, and is part of each Division-15 section making reference to supports and anchors specified herein.

C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.

B. Types of supports and anchors specified in this section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments and In-Beds.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Anchors.
8. Equipment Supports.

C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

D. Relate this section to Section 15240 regarding seismic and vibration control.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

B. Shop Drawings:

1. Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. Code Compliance: Comply with applicable building, mechanical and plumbing codes pertaining to product materials and installation of supports and anchors.

2. UL and FM Compliance: Provide products which are UL-listed and FM approved.

3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

b. Select and apply pipe hangers and supports, complying with MSS SP-69.

c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.

d. Terminology used in this section is defined in MSS SP-90.

PART II - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory- fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevises Hangers: MSS Type 1. (For suspension of non-insulated or insulated stationary pipe lines; 1/2" to 30".)

C. Steel Double Bolt Pipe Clamps: MSS Type 3. (For suspension of pipe requiring up to 4" of insulation and where flexibility of clamp is desirable; 3/4" to 24".)

D. Steel Pipe Clamps: MSS Type 4. (For suspension of cold pipe lines or hot lines where little or no insulation is required; 1/2" to 24".)

E. Pipe Hangers: MSS Type 5. (For suspension of piping when off-center closure allowing installation of hanger before erection of piping is desired; 1/2" to 4".)

F. Adjustable Swivel Pipe Rings: MSS Type 6. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)

G. Adjustable Steel Band Hangers: MSS Type 7. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)

H. Adjustable Band Hangers: MSS Type 9. (For suspension of non-insulated stationary pipe liens: 1/2" to 8".)

I. Adjustable Swivel Rings, Band Type: MSS Type 10. (For suspension of non-insulated stationary pipe lines: 3/8" to 8".)

J. Split Pipe Rings: MSS Type 11. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)

K. Extension Split Pipe Clamps: MSS Type 12. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)

L. U-Bolts: MSS Type 24. (For support of heavy loads; 1/2" to 30".)

M. Clips: MSS Type 26. (For support of uninsulated piping not subject to expansion or contraction.)

N. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange. (To support pipe from floor stanchion, using floor flange to secure stanchion to floor 4" to 36".)

O. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange. (To Type 36 except U-bolt provided for retaining pipe.)

2.2 VERTICAL-PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8. (For support and steadying of pipe risers; 3/4" to 20". Also supports pipe covering or insulation.)

C. Four-Bolt Riser Clamps: MSS Type 42. (When longer ends are required for riser clamps.)

2.3 HANGER-ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13. (For adjustment up to 6" for heavy loads.)

C. Steel Clevises: MSS Type 14. (For use on high temperature piping installations.)

D. Swivel Turnbuckles: MSS Type 15. (For use with split pipe rings, MSS type 11.)

E. Malleable Iron Sockets: MSS Type 16. (For attaching hanger rod to various types of building attachments.)

2.4 BUILDING ATTACHMENTS AND IN-BEDS:

A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Concrete Inserts: MSS Type 18. (For upper attachment for suspending pipe hangers from concrete ceiling.)

C. Top Beam C-Clamp: MSS Type 19. (Use under roof installations with bar joist construction, for attachment to top flange of structural shape.)

D. Side Beam or Channel Clamps: MSS Type 20. (For attachment to bottom flange of beams, channels, or angles.)

E. Center Beam Clamps: MSS Type 21. (For attachment to center of bottom flange of beams.)

F. Welded Beam Attachments: MSS Type 22. (For attachment to bottom of beams where loads are considerable and rod sizes are large.)

G. C-Clamps: MS Type 23. (For attachment to structural shapes.)

H. Top Beam Clamps: MSS Type 25. (For attachment to top of beams when hanger rod is required tangent to edge of flange.)

I. Side Beam Clamps: MSS Type 27. (For attachment to bottom of steel I-beams.)

J. Steel Beam Clamps with Eye Nut: MSS Type 28. (Same as Type 28 with link extensions.)

K. Linked Steel Clamps with Eye Nut: MSS Type 29. (Same as Type 28 with link extensions.)

L. Malleable Beam Clamps: MSS Type 30. (For attachment to structural steel.)

M. Steel Brackets: One of the following for indicated loading:

1. Light Duty: MSS Type 31, to 570 pounds.

2. Medium Duty: MSS Type 32, to 1,500 pounds.

3. Heavy Duty: MSS Type 33, to 3,000 pounds.

N. Side Beam Brackets: MSS Type 34. (For use on sides of steel or wooden beams.)

O. Plate Lugs: MSS Type 57. (For attachment to steel beams where flexibility at the beam is desired.)

P. Horizontal Travelers: MSS Type 58. (For supporting piping systems subject to linear horizontal movements where head room is limited.

2.5 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; see section Mechanical Insulation for void fill requirements. Use for roller supports and on all pipes 10" and larger.

C. Protection Shields: See section Mechanical Insulation.

D. Thermal Hanger Shields: See section Mechanical Insulation.

E. Manufacturer; Subject to compliance with requirements, provide thermal hanger shields of one of the following:

1. Elcen Metal Products Co.
2. Pipe Shields, Inc.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:

1. Kin-Line, Inc.
2. Fee & Mason Mfg. Co.: Div. Figgie International
3. ITT Grinnel Corp.
4. B-Line
5. Unistrut

2.7 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Use Embeco grout for non-shrink applications.

D. Heavy Duty Steel Trapezes: Fabricate from factory built channel (Unistrut) system and use factory fasteners for channel steel shapes, selected for loads required; weld steel in accordance with AWS standards.

PART III - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms.

Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to rigidly support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by isolating with foam rubber covering or 30 mil insulating tape.

D. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

2. Install supports within 2 feet of non-vertical flex connectors.

E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Insulated Piping: Do not allow hangers to come in contact with pipe where pipe is specified to be insulated.

H. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

I. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install galvanized steel protective shields. Install calcium silicate blocks (12" long minimum) at support points.

J. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.5 INSTALLATION OF ANCHORS:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS:

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 15. Size bases to extend a minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.7 ADJUSTING AND CLEANING:

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15140

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SECTION 15250 - MECHANICAL INSULATION

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work of this section.

B. Division-15, Section 15000 - General Mechanical Requirements applies to work of this section.

1.2 SUMMARY:

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules as required by the current Model Energy Code, and by requirements of this section. Use no asbestos in this work. Include restorations of insulations of damaged work including repair of damaged existing insulation due to new work.

B. Types of mechanical insulation specified in this section include the following:

1. Piping Systems Insulation:

   a. Fiberglass.
   b. Flexible Unicellular

2. Ductwork System Insulation:

   a. Fiberglass.
   b. Rigid Flexible Wrap.

C. Refer to Division-15 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields.

D. Refer to Division-15 section "Ductwork" for duct linings.

E. Refer to Division-15 section "System Identification" for installation of identification devices for piping, ductwork, and equipment.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide mechanical insulation materials of one of the following (except as noted):

1. Armstrong World Industries, Inc.
2. Babcock and Wilcox Co., Insulating Products Div.
3. CertainTeed Corp.
4. Knauf Fiber Glass GmbH.
5. Manville Products Corp.
6. Owens-Corning Fiberglass Corp.
7. Pittsburgh Corning Corp.
8. Rubatex Corp.
9. Thermacel
10. Imcoa

2.2 PIPING INSULATION MATERIALS:

A. Preformed Fiberglass Piping Insulation: ASTM C 547. (Class 1 for use to 450°F (230°C); Class 2 for use to 650°F (345°C); Class 3 for use to 1200°F (650°C).

B. Flexible, Unicellular Pipe Insulation: Closed-cell elastometric, preformed, with heat fusion or contact cement joining system. Insulation may be compressed but not stretched. By Armaflex II or Rubatex.

C. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of Armstrong Wb Armaflex Finish.

D. Jackets for Piping Insulation: All purpose (ASJ) fire retardant jacket, ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

E. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

F. Encase exterior fittings insulation with aluminum jacket with weather-proof construction.

G. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

H. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

I. Insulation Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

J. Thermal Hanger Shields: constructed of 360 degrees insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation

2.3 DUCTWORK INSULATION MATERIALS:

A. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type 1 - resilient, flexible; Class B-1 - 0.65 lbs/ft^3; Class B-2 - 0.75 lbs/ft^3; Class B-3 - 1.0 lbs/ft^3; Class B-4 - 1.5 lbs/ft^3; Class B-5 - 2.0 lbs/ft3; Class B-6 - 3.0 lbs/ft^3; Type II - flexible; Class F-1 - 4.5 lbs/ft^3; Type III - semirigid; Class F-2 - 4.5 lbs/ft^3.

B. Flexible Unicellular Sheet Insulation: ASTM C 534, Type I or II.

C. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes ad similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 PIPING SEALANT THROUGH WALLS:

A. Sealant shall be a two-part foamed silicone elastomer equal to Dow Corning 3-6548 Silicone RTV foam or equivalent by 3M or Spec Seal by STI. Sealant shall be applied at any piping of pipe or duct penetration through fire or smoke walls to prevent air from passing through the opening.

B. Sealant cell structure, foamed in place, shall be U.L. classified and shall meet the smoke development and fuel contribution ratings specified. Sealant shall be stable at extreme temperatures, and shall effectively confine such hazards as fire, smoke and gases.

C. Sealant required at any fire/smoke wall penetration to be according to approved detail for each specific wall assembly. Contractor shall submit detail for engineer approval.

2.5 FIRE/SMOKE ENCASEMENT:

A. Any and all PVC, PVDF, polypropylene, acid waste and vent and any other plastic piping located in return air plenums shall be encased in rated flame and smoke system. The encasement shall be equal to Firemaster Plastic Pipe Fire Protection System. The enclosure shall meet all codes.

PART III - EXECUTION

3.1 GENERAL:

A. Piping insulation shall be fiberglass one-piece preformed pipe insulation, class related to temperature, with all purpose (ASJ) fire retardant jacket, additional jacketing as noted.

B. Fittings and valves shall be insulated and covered with Zeston covers.

C. All cold water, chilled water, roof drains or any other lines upon which condensate moisture could form, shall have a vapor-proof jacket.

D. Fire and smoke hazard for a complete insulation system shall not exceed:

1. Flame spread - 25
2. Fuel contribution - 50
3. Smoke development - 50

E. Hangers shall not contact pipe where pipe is specified to be insulated.

3.2 INSPECTION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.3 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions strainers check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, fire protection piping, and pre-insulated equipment.

B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:

a. Potable cold water piping.

b. Plumbing vents within 6 lineal feet of roof or wall outlet.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass with all service jacket, self sealing lap:
b. 1" thickness, taped and sealed joints.

C. Hot Piping:

1. Application Requirements: Insulate the following hot plumbing piping systems:

a. Potable hot water piping.

b. Hot drain piping (where indicated).

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass with all service jacket, self-sealing lap: 1" thick for pipe sizes up to and including 6", 1-1/2" thick for pipe sizes over 6".

3.4 HVAC PIPING SYSTEM INSULATION:

A. Refrigerant Piping:

1. Application Requirements: Insulate the following HVAC piping systems.

a. Refrigerant piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.

a. Closed cell elastomeric.

B. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing under shrouding, paint any insulation not covered by shrouding.

3.5 DUCTWORK SYSTEM INSULATION:

A. Hot, Cold and Dual Temperature Ductwork:

1. Application Requirements: Insulate the following ductwork:

a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.

b. HVAC supply ductwork between acoustically lined main ductwork and room terminal outlet. Insulate neck and bells of supply diffusers. Note that insulation is not required on acoustically lined ductwork installed within the building insulation envelope. Ductwork installed outside of the building insulation envelope, i.e. in attic spaces shall be wrapped as described below in section 3.5.A.3.

c. HVAC return ductwork between room terminal inlets and acoustically lined main ductwork. Note that insulation is not required on acoustically lined ductwork installed within the building insulation envelope. Ductwork installed outside of the building insulation envelope, i.e. in attic spaces shall be wrapped as described below in section 3.5.A.3.

2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:

   a. Flexible Fiberglass: 1-1/2" thick.

3. Ductwork installed outside the building envelope, i.e. in attic spaces, regardless of acoustical lining shall be wrapped with 2" thick flexible fiberglass insulation.

B. Duct Insulations:

1. Wrap insulation snugly on the ductwork such that maximum thickness is maintained. Butt all circumferential joints and overlap longitudinal joints a minimum of 2". Adhere insulation with 4" strips of Insulation Bonding Adhesive, at 8" on center.

2. On circumferential joints, staple the 2" flange of the facing with 9/16" flare-door staples on 6" centers and taped with minimum 3" wide foil reinforcing Kraft tape. Tape all pin penetrations or punctures in the facing.

3.6 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Provide neatly beveled edge at all terminations and interruptions of insulation.

I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

J. Saddles and Shields:

1. General: Except as otherwise indicated, provide protection saddles or thermal inserts with protection shields under all piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and thermal inserts for exact fit to mate with pipe insulation.

2. Protection Saddles: See section Supports and Anchors for saddle. Fill interior voids with segments of insulation matching adjoining insulation.

3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation. Use on pipes 1-1/4" and smaller. Use with thermal hanger shields for pipes 1-1/2" and larger.

4. Thermal Inserts: High density calcium silicate insulation 360 degree coverage/encasement. Provide assembly of same thickness as adjoining insulation. Use on pipes 1-1/2" to 8".

3.7 INSTALLATION OF DUCTWORK INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

H. Corner Angles: Install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.8 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during construction period to avoid damage and deterioration.

END OF SECTION 15250

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SECTION 15410 - WATER DISTRIBUTION PIPING AND EQUIPMENT

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building.

B. Water Supply Systems:

1. Domestic Water
2. Rough-in and Connect

C. Domestic Water Equipment:

1. Domestic Water Expansion Tank
2. Water Meter

D. Related Sections:

1. Separate sections in Division 15 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements, general duty valves, pipe insulation, domestic hot water heaters and plumbing fixtures and equipment.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications:

1. Firms regularly engaged in the manufacture of plumbing piping products and equipment of types, materials and sizes required, whose products have been in service for not less than five years.

B. Installer's Qualifications:

1. Firm with at least three years history of successful experience on projects of similar nature.

2. Licensed as a firm in the Contractor state of origin and in the State of Nevada.

3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturers technical literature indicating source, brand, type, model, performance characteristics, installation instructions, etc. Color chart for finished surfaces and fixtures.

B. Record Drawings: See Section 15000 - General Mechanical Requirements.

C. Operation And Maintenance Information: Provide information for all equipment including a comprehensive system operating description. See Section 13995 - System Commissioning, Testing and Balancing.

1.5 REFERENCES:

A. Codes and Standards: Comply with applicable sections, follow recommended practices.

1. State Boiler and Pressure Vessel Regulations

2. ASME Codes for Boilers and Pressure Vessels

3. State and Local Plumbing Code

4. State and Local Mechanical Code

5. State and Local Building Code

6. ASHRAE/ASPE Handbooks

7. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".

8. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".

9. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Store pipe in a manner to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING:

A. Coordinate the installation of pipe sleeves for foundation wall and floor penetrations.

PART II - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Domestic Water Pipe: (except below slab/grade)

1. Pipe Sizes 4" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard

temper, copper tube; ASME B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin antimony solder or non-lead bearing solders such at "Silvabrite."

B. Domestic Water Pipe Below Slab/Grade:

1. Copper Tube: ASTM B 88 Type "K", seamless water tube, annealed temper. Wrap piping with scotch wrap and then cover with 1/2" thick "Therma-cel" continuous. Set wrapped pipe in 3" sand or pea gravel all around.

2.2 VALVES:

A. Ball, check, and drain valves are specified in Section 15100 - Valves.

2.3 PIPING SPECIALTIES:

A. Backflow Preventers:

1. Reduced pressure principle assembly consisting of FDA approved epoxy coated resilient seated ball valve shutoff valves on inlet and outlet, and FDA approved epoxy coated strainer on inlet, airgap drain. Assemblies shall include 4 test cocks, and pressure-differential relief valve located between two positive seating check valves, and comply with requirements of ASSE Standard 1013. Install line size where required by code.

2. Manufacturer: Subject to compliance with requirements, provide backflow preventor of one of the following:

a. Watts Regulator Series 909 QT-FDA-S
b. Febco 825Y
c. Wilkins

B. Strainers: (3" and smaller):

1. Watts No. 777, WWP 250 psi at 210°F, cast bronze body, threaded, solid retainer cap, 20 mesh stainless steel screen (except 3" to have 3/64" perforated screen).

2. Approved Manufacturer:

a. Watts Series 777.

C. Pressure Reducing Valves (1-1/2" and Smaller):

1. Bronze body construction integral stainless steel strainer renewable stainless steel seat. High temperature resistant diaphragm. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

2. Approved Manufacturers:

a. Watts U5B.
b. Wilkins.
c. Conbraco.

D. Non-Freeze Wall Hydrant:

1. (WH) Fixture:

   a. Bronze hydrant, exposed type removable key, vacuum breaker, automatic draining, stainless steel operating stem, rough brass finish.

   b. Approved Manufacturers:

      (1) Smith
      (2) Woodford No. 65
      (3) Zurn

2.4 DOMESTIC WATER EXPANSION TANKS:

A. Extent of Work: Tanks as indicated on drawings, clarify size and model, provide related piping valves, concrete pad or overhead suspension, line to drain, relief valve downstream of PRV's. Change air side to local water system static pressure.

B. Expansion Tanks: Factory built unit pressurized diaphragm type, ASME stamped for 125 psig working pressure. Steel tank with neoprene diaphragm and polypropylene liner for nonmetallic isolation of water from steel. Fit tank with air charging valve and threaded water connection. NSF approved.

C. Approved Manufacturers:

1. Amtrol "ST" Series
2. Bell and Gossett
3. Taco.

D. Installation: Install complete. Provide shut-off valves to system and to drain.

2.5 WATER METER:

A. Extent of Work: Provide turbine type water meter for required service on this project. Include all related installation with support, union, isolation valves, bypass, etc.

B. Equipment: Provide turbine type meter constructed to comply with all performance and material standards of AWWA C701, 175 psi working pressure. Bronze housing with flanged connections with sealed register reading gallons sized for 200 gpm flow rate at maximum of 5 psi pressure drop with accuracy of 100% ± 1% of flow.

C. Manufacturer: Sensus, DRS or Precision.

PART III - EXECUTION

3.1 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

C. Do not proceed until the unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS:

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. PVC Pipe: Joining and installation of PVC distribution pipe and fittings shall conform to ASTM D2855. Install in continuous "V" channel support system.

3.3 PIPING INSTALLATION:

A. Refer to the separate Division 15 section: General pipes and fittings, for general piping installation instructions.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

C. Install piping level with no pitch.

D. Install incidental.

3.4 INSTALLATION OF VALVES:

A. Installation requirements for general duty valves are specified in Section 15100.

B. Valves: Install in locations shown on drawings. Provide isolation valves for branch lines and service to all equipment, shown or not.

C. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.

D. Hose Bibbs and Wall Hydrants: Install with vacuum breaker. Each and every hose bibb or wall hydrant shall have a ball valve located upstream of its individual hose bibb or wall hydrant. Locate ball valve in accessible work space.

3.5 INSTALLATION OF PIPING SPECIALTIES:

A. Install pressure regulating valves with inlet and outlet shutoff valves, and ball valve bypass. Install pressure gage on valve outlet.

3.6 EQUIPMENT CONNECTIONS:

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

3.7 FIELD QUALITY CONTROL:

A. Inspections:

1. Do not enclose, cover, or put water distribution piping system into operation until it has

been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

5. Re-inspection: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.

6. Reports: Prepare inspection reports, signed by the plumbing official.

B. Test all water distribution piping systems for leaks and defects. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

C. Leave all water distribution piping uncovered and unconcealed until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

D. Cap the piping system and subject to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.

E. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

F. Prepare reports for all tests and required corrective action.

3.8 ADJUSTING AND CLEANING:

A. Cleaning and Disinfecting:

1. Purge all water distribution piping systems.

2. Follow AWWA guidelines. Thoroughly sterilize the entire domestic water system with a solution containing not more than 50 parts per million of available chlorine. Introduce the chlorinating materials into the system in a manner approved by the Owner's representative. Allow the sterilization solution to remain in the system for a period of 24 hours, during which time, open and close all valves and faucets several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million. Water system will not be accepted until a negative bacteriological test is made on water taken from the system. Repeat dosing as necessary until such negative test is accomplished.

B. Reports:

1. Prepare reports for all purging and disinfecting activities.

3.9 INSTRUCTION OF OWNER'S PERSONNEL: Participate in specified instruction. See Section 15000 - General Mechanical Requirements.

END OF SECTION 15410

SECTION 15420 - DRAINAGE AND VENT SYSTEMS AND EQUIPMENT

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. This Section specifies building sanitary and vent, storm drainage, including drains and drainage specialties.

B. Related Sections:

1. Separate sections in Division 2 specify foundation drainage, underduct drainage, storm sewage systems, sanitary sewage systems and trenching and backfilling. Provide a complete transition between work components.

2. Separate sections in Division 7 specify flashing and sheet metal and joint sealers.

3. Division 15 Basic Mechanical Requirements section applies to the work of this section.

4. Separate sections of Division 15 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements, pipe insulation, and plumbing equipment.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications:

1. Firms regularly engaged in the manufacture of plumbing piping products and equipment of types, materials and sizes required, whose products have been in service for not less than five years.

B. Installer's Qualifications:

1. Firm with at least three years history of successful experience on projects of similar nature.

2. Licensed as a firm in the Contractor state of origin and in the State of Utah.

3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

4. Employ workmen on the project who carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturers technical literature indicating source, brand, type, model, performance characteristics, installation instructions, etc. Color chart for finished surfaces and fixtures.

B. Record Drawings: See Section 15000.

C. Operation And Maintenance Information: Provide information for all equipment including a comprehensive system operating description. See Section 15000.

1.5 REFERENCES:

A. Codes and Standards: Comply with applicable sections, follow recommended practices.

1. State Boiler and Pressure Vessel Regulations

2. ASME Codes for Boilers and Pressure Vessels

3. State and Local Plumbing Code

4. State and Local Mechanical Code

5. State and Local Building Code

6. ASHRAE/ASPE Handbooks

7. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards."

8. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps."

9. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.6 SEQUENCING AND SCHEDULING:

A. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

PART II - PRODUCTS

2.1 WASTE, DRAIN AND VENT SYSTEMS:

A. Sanitary Soil Drain, Waste and Vent Piping: (Below Grade)

1. Piping and Fittings: Schedule 40 PVC pipe and fittings conforming to the requirements of ASTM D 2665. Pipe and fittings shall be produced domestically as supplied by Spears, or Charlotte Pipe and Fittings.

B. Sanitary Soil Drain, Waste and Vent Piping: (Above Grade Only)

1. Piping and Fittings: Schedule 40 PVC pipe and fittings conforming to the requirements of ASTM D 2665. Pipe and fittings shall be produced domestically as supplied by Spears, or Charlotte Pipe and Fittings.

2.2 EQUIPMENT AND SYSTEM VENTS AND DRAINS:

A. Piping:

1. Piping on closed side of system to match primary system served.
2. Open vent and drain piping of Schedule 40 PVC or Type K or L copper.

B. Valves: Provide valves appropriate for duty.

1. Locate air vent valves accessibly mounted on wall, 5'-0" above floor, extended to drain.

C. Installation Notes:

1. Slope all drains at 1/4" per foot or more.

2. Provide complete condensate drain systems for all furnaces and cooling coils, etc., and for all equipment which has a need for such service. Terminate such drain systems near floor drains, floor sinks or other authorized point of discharge.

2.3 DRAINAGE PIPING SPECIALTIES:

A. Vent Flashing and Termination:

1. Vent pipes penetrating the roof shall be flashed and made watertight at the roof with sheet metal flashing. Vent pipes shall extend at least 12" above roof. Coordinate installation with detail on drawings and roofing contractor

B. Traps: Equip each fixture and piece of equipment connecting to the drainage system with a trap. Place each trap as near to the fixture as possible and no fixture shall be double trapped.

PART III - EXECUTION

3.1 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION FOR UNDERGROUND BUILDING DRAINS:

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint, dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 JOINING PIPES AND FITTINGS:

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. PVC Piping: Make solvent weld joints utilizing ASTM approved primers and glues per the piping manufacturers recommendations.

3.4 INSTALLATION:

A. Refer to the separate Division 15 section: Basic Piping Materials and Methods, for general piping installation instructions.

B. Install supports and anchors in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors."

C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Do not make a change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Install underground building drains to conform with the plumbing code, and in accordance with the manufacturers installation manuals. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Join pipe sections in accordance with manufacturer's recommendations for use of primers, cements, and other special installation requirements.

F. Install building drain pitched down at minimum slope of 1/4" per foot (2 percent), unless noted otherwise and approved by the authority having jurisdiction.

G. Extend building drain to connect to sanitary and storm sewer piping, of size and in location indicated for service entrance to building.

3.5 INSTALLATION OF PIPING SPECIALTIES:

A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

1. As required by plumbing code;
2. At each change in direction of piping greater than 45 degrees;
3. At minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
4. At the base of each vertical soil or waste stack.

B. Cleanout Covers: Install floor and wall cleanout cover for concealed piping, types as indicated.

C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.6 CONNECTIONS:

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.7 FIELD QUALITY CONTROL:

A. Inspections:

1. Do not enclose or cover drainage and vent piping system or put into operation until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

5. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.

6. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test:

1. Test for leaks and defects all new drainage and vent piping systems. If testing is performed in
segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

3. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

4. Prepare reports for all tests and required corrective action.

C. Surface Drainage Test: Restroom floors and all other floors with floor drains where there will be water or where water may get on floor shall be tested with water to make sure floors are watertight and there are no places where water stands.

3.8 ADJUSTING AND CLEANING:

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.9 PROTECTION:

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 15420

SECTION 15440 - PLUMBING FIXTURES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division 15, "Basic Mechanical Materials and Methods" sections apply to work of this section.

1.2 SUMMARY:

A. This Section specifies plumbing fixtures. The types of fixtures specified includes the following:

1. Water Closets
2. Lavatories
3. Floor Drains
4. Cleanouts
5. Faucets

1.3 SUBMITTALS:

A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with fixtures installed in countertops and cabinets. Furnish templates.

C. Color Charts: Submit manufacturer's standard color charts for fixture colors.

1.4 REFERENCES:

A. Codes and Standards:

1. ANSI Standards A117.1: "Specifications for Making Buildings and Facilities Accessible and Usable By Physically Handicapped People."

2. ADA: Americans with Disability Act.

3. International Plumbing Code.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommend temperatures to prevent damage.

B. Store fixtures and Trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

1.6 SEQUENCE AND SCHEDULING:

A. Schedule rough-in installations with the installation of other building components.

PART II - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer uniformity shall be as specified in Section 15000, Basic Mechanical Requirements under Project Options.

2.2 FIXTURES AND TRIM: The model numbers listed below have been carefully selected to help bidders in the submittal process of selecting fixtures and trim. The completeness and accuracy of these numbers must be verified during the bidding process. Any discrepancies between the model numbers and the fixture, or trim descriptions noted by a manufacturer during the bidding process will be reported to the Architect / Engineer for clarification. Clarifications will be made a part of the contract through an addendum only. The contractor is responsible for reporting any clarifications before the bid date as required in this specification.

A. Water Closets: (Flush Valve Type-Wall Mounted)

1. (P-1 Info Booth) ADA Compliant Fixture: (1.6 gal./flush, siphon jet)

a. Wall mounted, vitreous china, elongated bowl, top spud. Mounted so top of seat is 18" above finished floor.

b. Approved Manufacturers:

(1) Kohler - "Kingston" No. K-4330
(2) American Standard - "Afwall" No. 2257.103
(3) Eljer - " Signature " No. 111-2105
(4) Crane - "Placidus" No. 3446

2. (P-1 Info Booth) Flush Valve: (1.6 gal./flush) - Standard and ADA Use Fixture

a. Exposed, battery powered, automatic sensor operated, 6 volt DC input, low battery indicator light, furnish with initial battery(s), polished chrome plated flush valve, diaphragm operated, 1.6 gallon per flush, screw driver operated angled stop valve with back-check feature, vacuum breaker, wall escutcheon, spud escutcheon, fixture spud securing nut for 1" top spud.

b. Approved Manufacturers: (Typical for standard and ADA fixtures)

(1) Sloan "Optima Plus" No. 8113-1.6
(2) Delany "Impulse No. I-1402-1.6
(3) Zurn "ZER6000 Series"

3. (P-1 Info Booth) Seat:

a. (White) high impact plastic, open front, check hinge.

b. Approved Manufacturers: (Typical on standard use and ADA fixtures)

(1) Church No. 295C
(2) Beneke No. 527CH
(3) Bemis No. 1655-C
(4) Olsonite No. 95

B. Lavatory:

1. (P-2 Info Booth) ADA Fixture

a. Wall mounted, 18" x 20", vitreous china, front overflow, faucet holes on 4" centers, concealed arm carrier, mounted so bottom of lavatory is 29" above finished floor, furnish and install pre-formed insulation around P-trap and water supplies meet 25/50 flame/smoke rating.

b. Approved Manufacturers:

(1) Kohler "Kingston" No. K-2005
(2) American Standard "Lucerne" No. 0355.012
(3) Eljer "Delwyn" No. 051-1644.
(4) Crane "Harwich" No. 1-412-V.

2. (P-2 – Info Booth) Faucet: (Standard and ADA Fixtures for public restrooms)

a. Single handle, self closing metering type, aerator with flow control device producing 0.25 gallon discharge per handle actuation, chrome plated, perforated strainer assembly, vandal proof. Provide with mixing valve (MV) set at a maximum of 100° F (adjustable).

b. Approved Manufacturers:

(1) Delta 87T105 with 87T151 cover plate.
(2) American Standard
(3) Chicago Faucet
(4) Kohler

3. (P-2 - Info Booth) Pre-formed Insulation and Protective Cover:

a. Pre-formed foam or fiberglass insulation with two piece white PVC snap on cover with velcro closure, to fit P-trap and hot and cold water stops and supplies, meet 25/50 flame/smoke rating.

b. Approved Manufacturer:

(1) Buckaroos, Inc.
(2) Truebro
(3) or an engineer approved equivalent.

4. (P-2 - Info Booth) Supplies with Stops:

a. Chrome plated quarter turn cast brass angle stop, brass stem, gasketed seat, flexible, chrome plated copper riser, chrome plated escutcheon, compression type connections.

b. Approved Manufacturers:

(1) Brass Craft
(2) Eastman
(3) McGuire

5. (P-2 - Info Booth) P-Trap:

   a. 17 gauge, tubular brass, chrome plated and chrome escutcheons.

   b. Approved Manufacturers:

      (1) Dearborn
      (2) McGuire
      (3) Jameco
      (4) Sanitary Dash

6. (P-2 - Info Booth) Strainer:

   a. Drain with grid pattern strainer, cast brass, chrome plated. Provide offset type drain as required to maintain ADA clearances.

   b. Approved Manufacturers:

      (1) Kohler K-7715 (Offset type No. K-13885)
      (2) Jameco
      (3) Sanitary Dash
      (4) McGuire

D. Sinks:

1. (P-3 - Info Booth) Sink:

   a. Single compartment, counter mounted, 13" x 16" x 6-1/2" deep, 18 gauge type 304 stainless steel, 3 faucet holes on 4" centers, self rimming, sound deadened.

   b. Approved Manufacturers:

      (1) Just No. SL-1316-A-GR
      (2) Elkay No. LRAD-1316

6. (P-3 - Info Booth) Faucet:

   a. Underdeck mounted, 8" high rigid gooseneck spout, 2.2 gpm vandal proof aerator, ADA compliant wrist blade handles, supplies on 8" centers. Provide with tempering valve on hot water supply to limit hot water supply temperature to 110° F.

   b. Approved Manufacturers:

      (1) Chicago Faucet (consisting of the following components):
      Base: 785-SWLESSSPTCP
      Gooseneck: GN2AH8JKCP
      Aerator: E3VPJKCP

      (2) T & S Brass

7. (P-3 - Info Booth) Supplies and Stops:

   a. Chrome plated quarter turn cast brass angle stop, brass stem, gasketed seat, flexible chrome plated copper riser, chrome plated escutcheon, compression type connections.

   b. Approved manufacturers:

      (1) Brass Craft
      (2) Eastman
      (3) McGuire

8. (P-3 - Info Booth) Outlet Fitting and Tailpiece:

   a. Chrome plated 17 gauge cast brass.
   b. Approved Manufacturers:

      (1) Elkay No. LK-53
      (2) Just

9. Strainer:

   a. Basket strainer, stainless steel, stainless steel basket, neoprene stopper, locking shell, tailpiece. Provide offset type where required to maintain ADA clearances.

   b. Approved Manufacturers:

      (1) Jameco
      (2) Sanitary Dash No. SS3000W
      (3) McGuire
      (4) Elkay
      (5) Just

10. P-Trap:

   a. 17 gauge, tubular brass, cleanout plug, chrome plated and chrome escutcheons.

   b. Approved Manufacturers:

      (1) Dearborn
      (2) McGuire
      (3) Jameco
      (4) Sanitary Dash

E. Cleanouts:

1. Finished Walls:

   a. Approved Manufacturers:

      (1) Zurn No. Z-1445-1
      (2) J.R. Smith No. 4530
      (3) Wade No. W-8460-R
      (4) Josam No. 58790

PART III - EXECUTION

3.1 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine floors, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION:

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of ANSI A117.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Install a stop valve in an accessible location in the water connection to each fixture.

E. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

F. Seal fixtures to walls and floors using silicone sealant. Match sealant color to fixture color.

3.3 FIELD QUALITY CONTROL:

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, the retest. Also test for rigidity of fixtures hung on carriers, flush valves, etc.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.4 ADJUSTING:

A. Adjust water pressure at drinking fountains, faucets and flush valves to provide proper flow stream.

B. Replace washers of leaking or dripping faucets and stops.

3.5 CLEANING:

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.6 PROTECTION:

A. Provide protective covering for installed fixtures and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

END OF SECTION 15440

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the contract, including General and Supplementary Conditions, Division 01 Specification sections, apply to work of this section.

B. Other Division 15 sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of electric water heater(s) work is indicated on drawings and schedules and as herein described.

B. Provide all supporting installation with water piping and valves, relief valves, drains, etc., all required for a complete installation.

C. Refer to Division 16 sections for other electrical wiring including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Provide water heater components which are UL-listed and labeled.

2. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electric Code".

3. Provide safety relief valves which comply with ASME Boiler and Pressure Vessel Code, and are stamped with appropriate code symbols.

4. Energy Code for commercial and high-rise buildings - ASHRAE 90.1-1999. Comply with efficiencies and heat loss requirements of this code.

5. State Plumbing Code with local and state amendments.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions for each water heater.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring to water heaters. Submit manufacturer's ladder-type diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between portions of wiring that are factory-installed and portions that are to be field-installed.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components; remove from site and replace with new.

B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading water heaters, and moving units to final location for installation.

PART II - PRODUCTS

2.1 ELECTRIC INSTANTANEOUS TYPE WATER HEATER: (2 gallon maximum, 1,500 watt maximum)

A. General: Capacity as scheduled on drawings.

B. Heavy duty element, Foam insulation, Glass lined tank with anodic protection, six year limited warranty, Temperature & Pressure relief valve, ASHRAE 90.1 compliant for thermal efficiency and standby losses. Install with heat traps of inlet and outlet.

C. Manufacturer: Subject to compliance furnish water heater of one of the following:

1. A. O. Smith
2. American
3. State

PART III - EXECUTION

3.1 EXAMINATION: Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF WATER HEATERS:

A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Extend relief valve discharge to closest floor drain, or as indicated.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittals and installation requirements of Division-16 sections. Do not proceed with water heater start-up until wiring installation is acceptable to water heater installer.

3.3 FIELD QUALITY CONTROL:

A. Start-Up: Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION 15446

SECTION 15650 - REFRIGERATION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL MECHANICAL REQUIREMENTS:

A. All pertinent sections of Section 15000 - General Mechanical Requirements are a part of the work described in this section.

B. All pertinent sections of Section 15060 - General Requirements for Plumbing and Piping are a part of the work described in this section.

1.2 SUMMARY:

A. This section specifies:

1. Refrigeration piping systems and equipment for split type air conditioning systems.
2. Piping, valves, specialties.

1.3 STANDARDS:

A. International Building Code/International Mechanical Code

B. Local Codes and Ordinances

C. State Pressure Vessel Regulations

D. EPA Requirements.

1.4 SHOP DRAWINGS/SUBMITTALS:

A. Submit a list of all materials to be used indicating brand or source, type and service.

B. Submit shop drawings for all equipment, valves and specialties, including shop drawing showing proposed pipe routing, sizing, valving, etc.

1.5 CONTRACTOR QUALIFICATION:

A. The Piping Contractor for this work shall be licensed as a firm in the Contractor state of origin and in the state of Nevada.

B. The Contractor shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

C. All workmen employed in the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.6 SCOPE OF THE WORK:

A. Furnish and install all field fabricated refrigeration systems and related work to effect a complete installation.

B. Provide and install complete refrigeration piping systems and equipment for split air conditioning systems as indicated in the Contract Documents and as specified in this section. Make systems fully operational.

C. Piping, valves, specialties.

D. Other work indicated on the drawings.

1.7 INSTRUCTION OF OWNER'S PERSONNEL:

A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.

B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.

1.8 WARRANTIES: See Section 15000.

PART II - MATERIALS AND METHODS

2.1 EQUIPMENT: All major items of refrigeration equipment shall be as specified in the equipment schedules on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.

2.2 PIPING MATERIALS: Piping materials shall be as follows unless otherwise indicated on the applicable contract drawing:

A. Pipe: "ACR" Type L, hard drawing, degreased, sealed at mill copper tubing, ASTM B88-62, cleaned and sealed at the mill. Pre-charged refrigerant lines shall not be used.

B. Fittings: Long radius, wrought copper type equal to Mueller Streamline, ASME B16.22.1963.

2.3 VALVES, SPECIALTIES, ETC:

A. Filter-Dryer: On lines smaller than 3/4" O.D. filter-dryer shall be a sealed type using male flare fittings. Size shall be full line size. Filter-dryer shall be Sporlan, Mueller or Alco.

B. Sight Glass: Shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.

C. Flexible Connection: Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for system working pressure.

2.4 REFRIGERANT AND LUBRICATING OIL: The Contractor furnish and install all of the refrigerant required to develop the system to its full rating, and in addition to the initial charge, he shall be required to provide, without cost to the Owner, all required refrigerant for the proper operation of the refrigeration apparatus during the first year's operation. The contractor shall be required to provide the initial charge of lubricating oil for all refrigeration apparatus and related equipment. Loss of refrigerant and oil during the first year of operation shall be made good at the contractor's expense.

2.5 CONDENSING UNITS (CU-1):

A. Extent of Work: Provide small condensing units, complete in all components as indicated on the drawings.

B. Condensing Unit: Outdoor mounted, air cooled unit with scroll type compressor, air cooled coil, propeller type cooling fan, and solid state controls. Cabinet shall be constructed of galvanized steel, and finished with a baked enamel painting process. Unit access panels shall be removable

and shall provide full access to all internal components.

C. Fans: Outdoor fans shall be direct-drive propeller type with totally enclosed single phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.

1. Compressor: Compressors shall be fully hermetic scroll type with a complete oil system, crankcase heater, operating oil charge and motor. Motor shall be equipped with internal overloads which protect the compressor from over temperature and over current. Compressors shall also be equipped with high discharge gas temperature protection.

2. Outdoor Coil: Coil shall be constructed of seamless copper tubes mechanically bonded to enhanced aluminum fins.

3. Refrigeration Circuit: Refrigerant circuit components shall include brass service valves and port connections, thermostatic expansion valve, hi capacity filter/drier, sight glass, schrader type fittings with brass caps, pressure relief, and a full charge of refrigerant.

4. Safeties: The condensing unit shall contain the following safety circuitry and components.

   a. Time delay restart to prevent short cycling.
   b. Auto restart on power failure.
   c. High and low pressure switches.
   d. High pressure relief.
   e. Outdoor fan failure protection.
   f. Low Ambient Kit

5. Accessories: Provide the following accessories.

   a. Filter Dryer.
   b. Support Feet.

D. Approved Manufacturers:

1. Carrier HDC
2. Bryant

PART III - EXECUTION:

3.1 INSTALLATION OF CONDENSING UNITS (CU-1):

A. General: Use best practices of the trade in all installation. Installation shall conform to the American Standard Code for Pressure Piping, ASME B31.5-1962, Refrigeration Piping. Installed piping shall not interfere with the operation and accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in a straight manner, free from traps, and shall be provided with capped or plugged ends, as it is erected, to prevent dirt from entering the system. The piping system shall be provided with isolating cushions, Unistrut P2600 Uni-Cushion at all hangers to prevent vibration and sound from being carried to the building structure.

B. Slope of Refrigerant Lines: Slope suction lines down toward compressor 1" per 10 feet. Locate oil traps every 10 feet at all vertical rises against flow in suction lines. Suction line traps shall be standard one-piece traps.

C. Cleanliness: All refrigerant lines and fittings shall be absolutely clean to avoid system operating difficulties and contamination. Use a good cleaning agent.

D. Joints:

1. Brazed joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool, wire brush, or fine emery cloth before sweating.

2. An inert gas (such as oil pumped dry nitrogen) shall be continuously passed through the copper piping when brazing joints to prevent formation of copper oxide. Care shall be taken to prevent annealing of fittings and tubing when making connections. Joints shall be made with silver bearing brazing material.

E. Vibration Isolation: Install condensing units on vibration isolation base noted on contract documents. Secure base securely to structure and secure condensing units securely to base. Install flexible connections just downstream of service valves and before sight glass and filter dryer.

3.2 TESTING OF REFRIGERATION PIPING SYSTEM: After the installation of the refrigeration piping system has been completed and before insulation is applied, all pipes shall be tested and proven tight for a period of 24 hours at a pressure of 300 pounds per square inch using oil pumped dry nitrogen.

3.3 EVACUATION AND CHARGING: After completion of the piping pressure test, the refrigeration systems shall be evacuated and dehydrated using a vacuum pump capable of producing at least 1 mm Hg absolute. The following procedure shall be followed unless otherwise noted:

A. Connect an accurate high vacuum gauge, such as Stokes or Zimmeril gauge to the system.

B. Connect the vacuum pump to both the high and low side of the system. Leave the compressor suction and discharge service valves closed. Start the vacuum pump.

C. Keep ambient air temperatures above 60° during the evacuation process.

D. Operate the vacuum pump until the system is evacuated to 2.5 mg Hg absolute.

E. Break the system vacuum with oil pumped dry nitrogen. Open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm Hg absolute.

F. After the system has been double evacuated to 2.5 mm Hg absolute, close the vacuum pump suction valve and stop the pump. Allow the system to stand under a vacuum a minimum of 12 hours. If no noticeable rise in pressure has taken place after 12 hours, the system may be charged. This test shall be made in the presence of the Owner's representative.

END OF SECTION 15650

Weber State University
New Information Booth
Division of Facilities Construction Management

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Motors Drives and Electrical Requirements for Mechanical Systems, General Mechanical Requirements, and General Pipes and Fittings sections apply to work of this section.

1.2 SUMMARY:

A. Types of terminal units required for project include the following:

1. Fan Coil Units (electric)

PART II - PRODUCTS

2.1 FAN COIL UNITS:

A. General: Provide fan coils having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, DX cooling coil, electric heating element, fanboard, fan wheels, housings, filter rails, motor, electric junction box and insulation.

B. Chassis: Galvanized steel wrap-around structural frame with edges flanged.

C. Insulation: Faced, heavy density glass fiber.

D. Fans: Provide centrifugal, forward curved double width fan wheels. Construct fan scrolls of galvanized steel.

E. Motors: Multispeed, direct drive, PSC type.

F. Filters: Provide 1" thick throwaway type filters in fiberboard frames.

G. Controls: Provide with factory wired terminal strip, transformer and electric contactor for heating element.

H. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:

1. Carrier FF1E
2. Bryant

PART III - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF FAN COIL UNITS:

A. General: Install Fan Coils as indicated, and in accordance with manufacturer's installation instructions.

B. Locate Fan Coil as indicated.

C. Provide and install blocking for wall hung units.

3.3 ELECTRICAL WIRING:

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Coordinate with the ceiling system.

3.4 ADJUSTING AND CLEANING:

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 15830

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New Information Booth
Division of Facilities Construction Management

SECTION 15870 - POWER VENTILATORS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 General Mechanical Requirements sections apply to work of this section.

C. See Section 15170 Motors, Drives and Electrical Requirements for Mechanical Work.

1.2 SUMMARY:

A. Extent of power and gravity ventilator work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of power and gravity ventilators specified in this section include the following:

1. Power ventilators.

a. Ceiling Exhaust Fans

C. Refer to Division-13 section "System Commissioning, Testing and Balancing" for balancing of power and gravity ventilators; not work of this section.

D. Refer to Division-15 temperature control systems sections for control work required in conjunction with power and gravity ventilators; not work of this section.

E. Refer to Division-16 sections for the following work; not work of this section.

1. Power supply wiring from power source to power connection on ventilators. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

2. Interlock wiring between ventilators; and between ventilators and field-installed control devices as shown in Division 16.

a. Interlock wiring specified as factory-installed is work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of power and gravity ventilators, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 15.

1.5 REFERENCES:

A. Codes and Standards:

1. AMCA Compliance: Provide power ventilators which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Rating Seal.

2. UL Compliance: Provide power ventilators which are listed by UL and have UL label affixed.

3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

PART II - PRODUCTS

2.1 CEILING EXHAUST FANS: (CEF)

A. Ceiling mounted fans shall have acoustically insulated housings and shall have a maximum sound level rating of 4.6 sones. Fans shall bear the AMCA seal and the UL label. Integral backdraft damper shall be totally chatterproof with no metal to metal contact. Fans shall have true centrifugal wheels. Entire fan, motor and wheel assembly shall be easily removable without disturbing the housing. Furnish unit with appropriate ceiling grille having a minimum 85% free open area. Motor speed shall not exceed 1050 rpm. All motors shall be suitably grounded and mounted on rubber in shear vibration isolators. Hang fan from structure on metal bands. The fan shall turn on as noted.

B. Manufacturer:

1. Broan
2. Cook.
3. Greenheck.

PART III - EXECUTION

3.1 INSPECTION:

A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF POWER AND GRAVITY VENTILATORS:

A. General: Except as otherwise indicated or specified, install power ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.

B. Coordinate ventilator work with work of walls, roof and ceilings, as necessary for proper interfacing.

C. Ductwork: Refer to Division-15 section "Ductwork." Connect ducts to ventilators in accordance with manufacturer's installation instructions.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

E. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

3.3 FIELD QUALITY CONTROL:

A. Testing: After installation ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.4 ADJUSTING AND CLEANING:

A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15870

SECTION 15890 - DUCTWORK

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 SUMMARY:

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork required for the project include the following:

1. Rectangular
2. Round

C. Exterior Insulation of metal ductwork is specified in other Division-15 sections, and is included as work of this section.

D. Refer to other Division-15 sections for exterior insulation of metal ductwork; not work of this section.

E. Refer to other Division-15 sections for ductwork accessories; not work of this section.

F. Refer to other Division-15 sections for mechanical controls; not work of this section.

G. Refer to other Division-15 sections for grilles and diffusers; not work of this section.

H. Refer to other Division-13 sections for system commissioning, testing and balancing; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.

1. The installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spacial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.

2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems".

4. International Building Code/International Mechanical Code: Comply with all sections pertaining to mechanical work.

B. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART II - PRODUCTS

2.1 DUCTWORK - GENERAL:

A. Standards: All duct fabrications shall comply with standards and techniques detailed by SMACNA "Duct Construction Manuals" for the appropriate pressure class, with the ASHRAE Handbook, 1988 edition, Chapter 1, Duct Construction, and with the contract drawing details.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; mill phosphatized for exposed locations.

2.2 FITTINGS AND FABRICATION:

A. Fittings: Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Fabricate elbows utilizing inside and outside radiuses with a center-line radius equal to associated duct width; or where fully radiused elbows are not possible, fabricate elbows with an inside square and outside radius and include turning vanes in the first 1/3 of elbow. Maintain duct width throughout turn on inside square and outside radiused elbows. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

B. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Duct Accessories' for accessory requirements.

C. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with weld type fasteners.

D. Offset, transition, adapt ductwork to structural obstacles and work of other trades in a coordinated effort. Layout work to avoid conflict with piping, etc. With review of conditions, teardrop around conflicting piping, lights, etc., all at no added cost to the owner.

2.3 DUCT PRESSURE CLASSIFICATIONS:

A. For all constant volume low pressure furnace systems:

1. Rectangular supply air and return air ductwork: Low pressure rectangular ductwork, 3" w.g.

2. Branch round supply air ductwork runout from rectangular ductwork to diffuser: Low pressure round ductwork, 1" w.g.

2.4 LOW PRESSURE ROUND DUCTWORK: (1" SMACNA Pressure Class)

A. Round type ductwork for use on low velocity supply systems (1200 fpm maximum), low pressure (0.75" maximum duct pressure), shall be fabricated on 26 gauge galvanized steel sheets with snap-lock longitudinal seams and crimped and beaded joints.

B. All end joints shall have at least three screw fasteners and joints shall be sealed airtight with Hardcast TA tape or water based duct sealer. Snap lock longitudinal seams shall be seal with water based duct sealer NO EXCEPTIONS. Elbows and fittings shall provide smooth air flow patterns and have a neat appearance.

C. Use factory fabricated elbows in lieu of the multi-sectional adjustable type.

2.5 LOW PRESSURE RECTANGULAR DUCTWORK: (3" SMACNA Pressure Class)

A. Rectangular ductwork for use on supply systems up to 2" maximum duct static pressure and 2000 fpm maximum duct velocity shall be constructed of galvanized steel using construction for nominal 3" SMACNA rated systems. Seal all transverse and longitudinal joints with water based duct sealer NO EXCEPTIONS.

B. Use radiused elbows, or square inside radiused outside elbows with single thickness turning vanes in the first 1/3 where space restrictions prohibit fully radiused elbows. Use 45° high efficiency tapping takeoffs with separate downstream balance dampers.

C. Duct dimensions are inside clear. Increase for acoustical lining.

2.6 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Runout Fittings: Runout fittings shall be used to make round to rectangular duct connections. Use 45° time and a half square to round fittings. Provide with locking quadrant dampers where balance is involved. Provide with insulation guard where insulated duct is involved.

C. Duct Sealing Compound: Duct sealing compound shall be 3M brand number EC-750 or Duro-Dyne S-2. This material shall be used in making up duct joints or in water proofing, caulking plenums, etc.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

PART III - EXECUTION

3.1 INSPECTION:

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF METAL DUCTWORK:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

1. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All of these changes, however, must be approved and installed as directed at project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering.

B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

C. Routing: Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures. Maintain clearances above of and in front of electrical panels.

E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.

F. Ducts At Structural and Architectural Penetrations: Where ducts are shown connecting to or passing through concrete, gypsum board, masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2-18 ga. galvanized angle which shall be screwed to the construction and made airtight to the same by applying caulking compound. Close openings between duct and structure.

G. Cross Breaking: Rectangular sheet metal ducts shall be cross broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.

H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

I. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

1. Related to final installation cleanliness, damp wipe all ductwork on installation. Cap open duct ends, cover fan inlets, vacuum fan plenums and related installation before starting fans. Run fans only with filters in place.

3.3 HANGERS AND SUPPORTS:

A. Support all ductwork in accordance with SMACNA standards.

3.4 SUPPORTING DAMPERS: Parallel and opposed blade motor operated dampers shall be supported by reinforcing the ductwork or sheet metal walls at the damper locations to carry the weight of the dampers and the force exerted on the dampers due to air pressure, or shall be supported independent of ductwork from the ceiling or floor, as conditions at the site determine.

3.5 DUCT SEALING: Seal all tranverse joints and longitudinal seams with approved sealer. Apply sealer to all joints in layers, look to achieve a final thickness of 1/32" over the entire joint.

3.6 AESTHETIC LAYOUTS: Contractor shall locate all diffusers, grilles and other exposed items in such a manner as to fit symmetrically in any grid system or other aesthetic architectural or lighting pattern. Refer to reflected ceiling plans and electrical lighting layouts for additional information. Provide duct offsets or extensions as required to make a proper installation.

A. Close or cap all duct ends. Use auxiliary blower with air flow meter to establish a duct pressure equivalent to the duct pressure class. Inspect all joints in duct system and seal all identifiable leaks.

3.7 EQUIPMENT CONNECTION:

A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.8 ADJUSTING AND CLEANING:

A. Clean ductwork internally of dust and debris, as follows: Before the ceilings are installed, with filters in place, operate the fans at full capacity to blow out dirt and debris from ducts. If it is not practical to use the main supply blower for this test, the ducts may be blown out in sections by a portable fan.

B. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

C. Balancing:

1. Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. However, the Sheet Metal Contractor shall participate fully in this work. Seal any leaks in ductwork that become apparent in balancing process.

2. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor and his subcontractors shall make any changes necessary to obtain the specified conditions.

END OF SECTION 15890

SECTION 15910 - DUCTWORK ACCESSORIES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY:

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork accessories required for project include the following:

1. Manual Dampers.
2. Turning vanes.
3. Duct hardware.
4. Flexible connections.

C. Refer to other Division-15 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

3. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.6 DELIVERY, STORAGE AND HANDLING:

A. PROTECTION: Protect shop-fabricated and factory-fabricated accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. STORAGE: Where possible, store accessories inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART II - PRODUCTS

2.1 MANUAL DAMPERS:

A. Dampers for balance only where tight shutoff is not critical are to be furnished and installed by this Section.

1. Exposed locations:

a. Honeywell D-640 (Rectangular), Honeywell D-690 (Round).
b. Ruskin CD-35 (Rectangular), Ruskin CDRS-25 (Round)
c. Johnson.

2. Concealed locations:

a. United Enertech – Power Balance line. Provide actuators, interconnecting Cat. 5 cable and mechanical room mounted punchdown blocks for all locations. Provide laminated damper legend in closet per contract documents.

2.2 TURNING VANES: Turning vanes shall be single thickness blades with ¾" trailing edge. Blade spacing shall be per SMACNA and contract document details. Install turning vanes in the first 1/3 of all inside square elbows and extend vane runner past last blade and secure to duct.

2.3 FLEXIBLE CONNECTIONS: Provide non-combustible flexible connections, constructed of heavy waterproof glass fabric double coated with neoprene, equal to Ventglas or Ventlon (exterior) as manufactured by Ventfabrics, Inc. Flexible connection shall not be less than 4" wide. Install at the inlet and outlet connection of each fan unit and at other locations shown on drawings. Securely fasten flexible connection to the unit and to the ductwork by a galvanized iron band, provided with tightening screws.

PART III - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES:

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install hand operated volume dampers at locations and of sizes shown. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct for exposed locations and cable controllers for concealed locations. Where ducts are insulated, the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be at least 1-1/2 times as long as the narrowest adjacent split, except where otherwise detailed. All multi-blade hand dampers shall be the product of one of the manufacturers listed in the Contract Documents. All operator fittings shall be heavy duty commercial grade as specified. All damper regulators installed above removable ceilings shall be painted fluorescent orange to ensure ease of visibility. Test all hand dampers for operability immediately after installation. Dampers shall actuate from fully closed to fully open position with no binding or interference. Dampers found non-operable during Test and Balance will be repaired at the contractor's expense.

C. Install turning vanes in the first 1/3 of all inside square outside radiused elbows in supply, return, and exhaust air systems, and elsewhere as indicated.

D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 FIELD QUALITY CONTROL:

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.4 ADJUSTING AND CLEANING:

A. Adjusting: Adjust ductwork accessories for proper settings.

1. Final positioning of manual dampers is specified in Division- 13 section "Testing, Adjusting, and Balancing".

2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15910

SECTION 15940 - AIR OUTLETS AND INLETS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

1. Ceiling air diffusers and grilles.

C. Refer to other Division-15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division-15 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.

1. The Installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".

2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

3. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART II - PRODUCTS

2.1 GRILLES AND DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Adjust all grilles and diffusers to fit neatly in the room ceiling pattern. Set final locations per architectural reflected ceiling plans.

E. Manufacturers: Subject to compliance with requirements, provide grilles and diffusers of one of the following:

1. Krueger
2. Carnes
3. Titus
4. EH Price
5. Metal Air
6. Naylor

F. Types: Provide grilles and diffusers of type, capacity, and with accessories and finishes as listed on grille and diffuser schedule and as specified herein.

G. Grilles and Diffusers:

1. Ceiling Supply Diffuser (S-1): Krueger series SH, square face, one, two three or four way blow as required. Square neck, anti-smudge border, all steel, white baked on enamel, size as indicated on drawings.

2. Return Grille (R-1): Krueger series S85H. Heavy duty steel construction, horizontal blades at 35° deflection with 1/2" spacing, mounting frame with concealed fasteners, sponge rubber gasket, white baked enamel finish, size as indicated on drawings.

PART III - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on Architectural "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

END OF SECTION 15940

SECTION 15955 - MECHANICAL CONTROL SYSTEMS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-15 General Mechanical Requirements sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.

1. See following sections for types of Control Systems included as a part of this section. See electrical, etc.

2. Control sequences are specified in this section under: "Sequence of Operation".

B. Refer to other Division-15 sections for installation of dampers in mechanical systems.

C. Refer to Division-16 sections for the following work.

1. Power supply wiring from power source to power connection on controls and/or unit control panels. Includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.

a. Interlock wiring specified as factory-installed is work of this section.

D. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:

1. Control wiring between field-installed equipment, controls, indicating devices, and unit control panels. All control wiring shall be in conduit.

2. 120 volt service required by control systems.

E. Participate in "System Commissioning, Testing and Balancing".

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: The HVAC controls shall be electric/electronic type

B. Installer's Qualifications: Firms and workmen specializing and experienced in electric control system installations for not less than 5 years.

C. Codes and Standards:

1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.

2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

4. Comply with NEPA 70, "National Electric Code" for all electrical installation.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.

B. Shop Drawings: Submit shop drawings for each control system, containing the following information:

1. Schematic flow diagram of system showing furnace, condensing unit, roof top unit, dampers, and control devices.

2. Label each control device with setting or adjustable range of control.

3. Indicate all required electrical wiring. Clearly differentiate between portions of work that are factory-installed and portions to be field-installed. Note contract responsibility to provide complete system regardless of delegation. Completely interface with and show existing installation in the Administration building.

4. Provide details of faces of control panels, including controls, instruments, and labeling.

5. Include verbal written description of sequence of operation. Confirm correct function of proposed sequences.

C. Samples: Submit sample of each type of proposed thermostat cover to ensure they match existing.

D. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Section 15195.

1.5 DELIVERY, STORAGE, AND HANDLING: Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

1.6 INSTRUCTION OF OWNER'S PERSONNEL: (See Section 15000)

A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.

B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.

C. Prepare an outline of information to be conveyed, list materials available for reference. Submit to Architect along with a proposed schedule of instruction. Schedule to allow individual time for each trade and each system.

D. Convey information in formal classroom session. Teachers to include qualified contractor personnel and sales representatives for each major piece of equipment. Go from the classroom to the actual location to graphically illustrate concepts discussed.

E. Each and every session shall be video taped by the Contractor and given to the Owner.

1.7 WARRANTIES:

A. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion).

B. Warrant the overall assembly of equipment, materials and labor comprising these systems.

1.8 CLEANING AND LUBRICATION: All instruments, and control panels shall be thoroughly cleaned before final acceptance.

1.9 TESTING AND ADJUSTING OF SYSTEM:

A. During the system commissioning, testing and balancing of the various building systems, have a controls representative(s) present and available to interpret and adjust controls as needed. Demonstrate and report the integrity and accuracy of each function and control point.

B. At the termination of the testing period, the Controls representative shall spend a minimum of 4 hours instructing the Owner's operating personnel in the control system operation, and checking each system for day-night and manual override with the Owner's operating personnel on each furnace system. A complete operating booklet shall be provided and used during the training period. Schedule this training with the Owner and Mechanical Contractor.

1. Since system performance is partly a function of climatic conditions, the Controls contractor shall be available during the changing seasons of the warranty period to make further adjustments and modifications if required. A final complete check of all systems shall be made at the conclusion of the one year warranty period.

PART II - PRODUCTS

2.1 CONTROL CABINETS: Furnish stamped steel with hinged door and locking latch control cabinets to protect and conceal all control devices. Arrange components neatly to provide adequate maintenance opportunity and proper device function. Label all components, numerically code all piping and wiring. Terminate all wiring at terminal blocks. Provide engraved plastic labels for all panel face devices.

A. Provide with fuse - quantity as required.

B. Provide with transformer 120/24 VAC quantity as required.

2.2 THERMOSTAT: (Typical of all furnaces)

A. Programmable low voltage type provided with automatic change over feature for both heating and cooling stages, seven day program with two starts and stops per day, and provisions for damper operators.

B. Approved Manufacturer & Model -

1. Honeywell TB8220 Series

2.3 TRANSFORMER:

A. 120/24 volt, 38VA Honeywell AT72D1188, cover mount

B. 120/24 volt, 50VA Honeywell AT87A1106, foot mount

2.4 DAMPER ACTUATORS:

A. Electric type equipped for Class I wiring.

B. Shall not consume power during UNOCCUPIED cycle or use chemicals or expandable media.

C. Have built in spring return.

D. Approved Manufacturer & Model -

1. Honeywell MS7505A2008

2.5 CONDUCTORS:

A. Color coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.

B. Thermostat Cable - 12 conductor or 8 conductor, 18AWG solid copper wire, insulated with high density polyethylene. Conductors parallel enclosed in brown PVC jacket (No 22 AWG cable allowed).

2.6 AUXILIARY RELAYS:

A. Light Duty - as required.

PART III - CONTROL SEQUENCES

3.1 GENERAL:

A. Provide control systems to manage and manipulate mechanical equipment in a functional and energy conserving way.

3.2 FAN COIL UNIT:

A. The Fan coil unit fan shall be set to run whenever the building is occupied based on a schedule dictated by the owner. Upon a drop in space temperature below setpoint (70°F) the thermostat shall energize the electric element in the fan coil unit and deliver heat to the space. Upon a rise in space temperature above setpoint (73°F) the thermostat shall energize the condensing unit and deliver cooling to the space. As the space temperature meets setpoint the thermostat shall de-energize either the heating section or condensing unit.

3.3 CEILING EXHAUST FAN (CEF):

A. The ceiling and inline exhaust fans shall be energized by the light switch in the room being served.

END OF SECTION 15955

SECTION 15990 – TESTING, ADJUSTING AND BALANCING

PART I - GENERAL

1.1 SECTION INCLUDES

A. Requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Testing, adjusting and balancing includes the following mechanical systems:

1. Supply air systems.

2. Return air systems.

C. Verification of temperature control system operation.

D. Testing of systems for proper sound and vibration levels.

1.2 DEFINITIONS

A. Systems Testing, Adjusting, and Balancing: The process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. Balance of air distribution systems.

2. Adjustment of total system to provide design quantities.

3. Electrical measurements.

4. Verification of performance of all equipment and automatic controls.

5. Sound and vibration measurement.

B. Test: Determine quantitative performance of equipment.

C. Adjust: Regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: Proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of work to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data shall also form the permanent record to be used as the basis for required future testing, adjusting, and balancing. Provide layout drawing showing location of all registers with identifiers correlated to test data sheets so individual CFMs can be located and verified.

G. Terminal: Point where controlled fluid enters or leaves the distribution system. These are supply outlets on air terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers and hoods.

H. Main: Duct containing the system's major or entire fluid flow.

I. Submain: Duct containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct serving two or more terminals.

K. Branch: Duct serving a single terminal.

1.3 SUBMITTALS

A. Agency Data: Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for the Project.

D. Reporting Forms: Submit forms intended to be used for recording and reporting testing, adjusting and balancing data. Forms shall comply with requirements of applicable referenced standards. Provide layout drawing with coded registers located.

E. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer.

1. Reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems.

2. Report Contents: Provide the following minimum information, forms and data:

a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project.

b. Include addresses, and contact names and telephone numbers.

c. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer.

d. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

e. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system.

f. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

1.4 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: Professional Engineer registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this Project.

B. Agency Qualifications: Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives.

C. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

D. Independent testing, adjusting, and balancing agency shall be certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this Project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

E. Codes and Standards: Comply with applicable requirements of the following.

1. AABC - National Standards For Total System Balance.

2. ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing.

F. PROJECT CONDITIONS

1. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART II - PRODUCTS

Not Applicable to this Section.

PART III - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform the following:

B. Obtain Contract Drawings and Specifications, including all addenda, change orders and other modifications made during construction.

C. Become thoroughly acquainted with the design intent. Consult with Architect's mechanical engineering consultant as necessary.

D. Obtain copies of reviewed submittals for all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

E. Obtain maintenance and operation data for equipment.

F. Compare design to installed equipment and field installations.

G. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

H. Check filters for cleanliness.

I. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

J. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

I. Determine best locations in main and branch ductwork for most accurate duct traverses.

J. Place outlet dampers in the full open position.

K. Prepare "as-built" schematic diagrams of HVAC system ductwork layouts to facilitate reporting. Label all terminal outlets on layouts and correlate labels to report.

L. Lubricate all motors and bearings.

M. Check fan belt tension.

N. Check fan rotation.

3.2 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments complying with specifications in referenced standards.

C. Use only those instruments which have maximum field measuring accuracy and are best suited to function being measured.

D. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

E. Use instruments in accordance with instrument manufacturer's instructions and recommendations.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with eye at level of indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in system where best suited to task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with detailed procedures outlined in referenced standards. Consult with engineer before performing tests.

B. Cut insulation, and ductwork for installation of test probes to minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of vapor retarder.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark location of test probes and ductwork and piping. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

H. Identify all test points on "as built" drawings and mark ductwork and fan housing with permanent identification materials. Markings on air handlers, ductwork, and diffuser outlets shall be correlated to balance reports.

3.4 TESTING FOR SOUND AND VIBRATION

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.5 RECORDING AND REPORTING DATA

A. Recording: Record all data obtained during testing, adjusting, and balancing on forms as reviewed by Architect.

B. Reporting: Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION 15990

PART I – GENERAL

1.1 GENERAL CONDITIONS:

A. Work of this section shall be subject to the requirements of the General Conditions of this contract. the General Mechanical Requirements, General Electrical Requirements and other sections where this work shares a responsibility. System commissioning and startup of the mechanical systems shall be the responsibility of the Mechanical Contractor and his subcontractors with the participation of the Electrical Contractor related to electrical work and the General Contractor related to general construction items.

1.2 SUBMITTALS

A. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

1. Shop Drawings
2. Commissioning Plan

B. Commissioning Plan prepared in accordance with Commissioning Standard, no later than 28 days after the approval of the Commissioning Specialist by the engineer.

C. Commissioning Firm

1. Certification of the proposed Commissioning Firm's qualifications by one of the following ACG, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed Commissioning Firm or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Firm shall be described in detail.

2. Commissioning Specialist Certification of the proposed Commissioning Specialist's qualifications by one of the following ACG, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed Commissioning Specialist or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Specialist shall be described in detail.

D. Installed Equipment

1. Pre-Functional Performance Test Checklists

a. At least 28 days prior to the start of Pre-Functional Performance Tests submit a checklist simi lar to those in Appendix A for each piece of equipment on the project. The checklist shall con tain at a minimum those items indicated in Appendix A with additional items added at the Commissioning Specialists or engineers discretion. A Pre-Functional Performance Test schedule shall also be submitted with the checklists so all applicable parties listed in appendix A can be notified and in attendance for system commissioning.

2. Functional Performance Tests

a. At least 28 days prior to the start of Functional Performance Tests submit a checklist similar to those in Appendix B for each piece of equipment on the project. The checklist shall contain at a minimum those items indicated in Appendix B with additional items added at the Commis sioning Specialists or engineers discretion. The design portion of all checklists shall be com

pleted at time of submittal for all equipment. A Functional Performance Test schedule shall be submitted with the checklists so all applicable parties listed in appendix B can be notified and in attendance for system commissioning.

E. Test Reports

1. Commissioning Report

a. No later than 14 days after completion of Functional Performance Tests.

i. Certificates

1.3 SYSTEM COMMISSIONING STANDARDS

A. Commissioning shall be performed in accordance with the requirements of the standard under which the Commissioning Firm's qualifications are approved, i.e., ACG Commissioning Guideline, NEBB Commissioning Standard, or SMACNA Commissioning Manual unless otherwise stated herein. All recommendations and suggested practices contained in the Commissioning Standard shall be consid ered mandatory. The Commissioning Standard shall be used for all aspects of Commissioning, include ing qualifications for the Commissioning Firm and Specialist and calibration of Commissioning instru ments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the Commissioning Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the Commissioning Standard, Commissioning procedures shall be developed by the Commissioning Specialist. Where new proce dures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the Commissioning Standard used (ACG, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.4 QUALIFICATIONS

A. Commissioning Firm: The Commissioning Firm shall be either a member of ACG or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications. The certification shall be maintained for the entire dura tion of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another Commissioning Firm for approval. Any firm that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of all other subcontractors. The Commissioning Firm shall report to and be paid by the prime Contractor.

B. Commissioning Specialist: The Commissioning Specialist shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Super visor and shall be an employee of the approved Commissioning Firm. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another Commissioning Specialist for approval. Any individual that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections performed

by the Commissioning Specialist shall be considered invalid if the Commissioning Specialist loses his certification prior to Contract completion and must be performed by the approved successor.

1.5 COMMISSIONING SPECIALIST RESPONSIBILITIES:

A. All Commissioning work specified herein and in related sections shall be performed under the direct guidance of the Commissioning Specialist. The Commissioning Specialist shall prepare the Commissioning Plan, which will be a comprehensive schedule and shall include all submittal requirements for procedures, notifications, reports and the Commissioning Report. After approval of the Commissioning Plan, the Contractor shall revise the Contract NAS schedule to reflect the schedule requirements in the Commissioning Plan.

1.6 SEQUENCING AND SCHEDULING:

A. The work described in this Section shall begin only after all work required in related Sections has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these Sections have been submitted and approved. Pre-Functional Performance Test Checklists shall be performed at appropriate times during the construction phase of the Contract.

PART II - PRODUCTS (Not Applicable)

PART III – EXECUTION

3.1 COMMISSIONING TEAM AND TEST FORMS AND CHECKLISTS

A. The specification checklists have been provided as guides for the preparation of project commissioning checklists. The commissioning firm shall utilize the included checklists as reference and submit to the designer a complete set of commissioning checklists for each piece of equipment. The designer will modify the submitted checklists where necessary for specific project requirements. Commissioning Team members shall be as defined below.

Designation	Function
A	Contractor's Commissioning Specialist
M	Contractor's Mechanical/Plumbing Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing (TAB) Specialist
C	Contractor's Controls Representative
U	Mechanical Engineer
O	Owners Representative

b. Appendices A and B shall be completed by the commissioning team. Acceptance by each commissioning team member of each Pre- Functional Performance Test Checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test item shall be indicated by signature and date.

3.2 TESTS

A. The pre-functional performance test checklists and functional performance tests shall be performed in a manner that essentially duplicates the checking, testing, and inspection methods established in the re lated Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide the information required. Testing and verification re quired by this section shall be performed during the Commissioning phase. Requirements in related

Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section. The Contractor shall provide all materials, services, and la bor required to perform the pre- functional performance tests checks and functional performance tests. A functional performance test shall be aborted if any system deficiency prevents the successful comple tion of the test or if any participating non-Government commissioning team member of which participa tion is specified is not present for the test.

1. Pre-Functional Performance Test Checklists

    a. Pre-Functional Performance Test Checklists shall be performed for the items indicated in Ap pendix A. Deficiencies discovered during these checks shall be corrected and re-inspected in accordance with the applicable contract requirements.

2. Functional Performance Tests

    a. Functional Performance Tests shall be performed for the items indicated in Appendix B. Functional Performance Tests shall begin only after all Pre-Functional Performance Test Checklists have been successfully completed. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any Functional Performance Test item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The item shall then be retested until it has been completed with no errors.

3.3 COMISSIONING REPORT

A. The Commissioning Report shall consist of completed Pre- Functional Performance Test Checklists and completed Functional Performance Tests organized by system and by subsystem and submitted as one package. The Commissioning Report shall also include all HVAC systems test reports, inspection reports (Preparatory, Initial and Follow-up inspections), start-up reports, TAB report, TAB verification report, Controls start-up test reports and Controls Performance Verification Test (PVT) report. The results of failed tests shall be included along with a description of the corrective action taken.

APPENDIX A PRE-FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Pre-Functional Performance Test Checklist – Fan Coil / Condensing Units

Checklist Item	A	M	E	T	C	U	O
Installation							
a. Access doors/removable panels are operable and fit properly.	___	___	X	___	X	___	___
b. Filters are clean	___	___	X	___	X	___	___

Electrical	A	M	E	T	C	U	O
a. Power available to unit disconnect.	___	X	___	X	X	___	X

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	U	O
a. TAB reporting form contents approved.	X	___	X	X	X	___	X

Pre-Functional Performance Test Checklist - HVAC System Controls

For All HVAC Systems:

Checklist Item	A	M	E	T	C	U	O
Installation							
a. Layout of control panel matches drawings.	___	___	___	___	___	___	___
b. Components properly labeled.	___	___	___	___	___	___	___
c. Control components wired to each labeled terminal strip.	___	___	___	___	___	___	___
d. Control wiring labeled at all terminations, splices, and junctions.	___	___	___	___	___	___	___

End of Appendix A

APPENDIX B

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

All Fan Coil Systems

1. Functional Performance Test: Contractor shall verify operation of each furnace as per specification including the following:

a. Verify units respond to thermostat changes.
c. Record cooling coil discharge temperature _____ F°
d Record unit return temperature _____ F°
e Record Temperature Drop _____ F°
f. Calculate installed _____ versus scheduled capacity _____ (BTU/Hr.)
g. Check unit discharge air temperature (heating mode) _____ F°
h. Record unit return temperature (heating mode) _____ F°
i. Record Temperature Rise _____ F°
j. Calculate installed _____ versus scheduled capacity _____ (BTU/Hr.)

Date and Signature

Contractor's Commissioning Specialist _____
Contractor's Mechanical Representative _____
Contractor's Electrical Representative _____
Contractor's TAB Representative _____
Contractor's Controls Representative _____
Contracting Officers Representative _____
Owners Representative _____

Functional Performance Test Checklist - HVAC Controls

For All HVAC Systems:

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the following Tests.

a. Verify each system is controlling off the control system by the following:

i. Artificially raise and lower the environment around each thermostat and verify correct unit response.

Note that the environment around the sensors can be raised and lowered through the use of a hair dryer and dry ice.

b. Verify that the discharge and outside air sensors are reporting the correct temperature to the thermostats.

4. Certification: We the undersigned have witnessed the Performance Verification Test and certify that the item tested have met the performance requirements in this section of the specifications.

Date and Signature
Contractor's Commissioning Specialist _____
Contractor's Mechanical Representative _____
Contractor's Electrical Representative _____
Contractor's TAB Representative _____
Contractor's Controls Representative _____

Weber State University
New Information Booth
Division of Facilities Construction Management

Contracting Officers Representative _____
Owners Representative _____

END OF SECTION 15995

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Architectural, Structural, Mechanical and other applicable documents also apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. The contract documents indicate the extent of electrical work. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system as described in division 16.

1.3 RELATED SECTIONS:

A. Other Divisions relating to electrical work apply to the work of this section. See other applicable Divisions including, but not necessarily limited to:

1. Division 1 - General and Supplementary Conditions
2. Division 2 - Existing Conditions
3. Division 3 - Concrete
4. Division 5 - Metals
5. Division 6 - Wood, Plastics, and Composites
6. Division 7 - Thermal and Moisture Protection
7. Division 8 - Openings
8. Division 9 - Finishes
9. Division 15 - Mechanical
10. Division 16 - Electrical

1.4 INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS:

A. Prior to bidding the job, submit requests for clarification in writing to the Architect/Engineer prior to issuance of the final addendum.

B. After signing the contract, provide all materials, labor, and equipment to meet the intent, purpose, and function of the contract documents.

C. The following terms used in Division 16 documents are defined as follows:

1. "Provide" - Means furnish, install, and connect, unless otherwise indicated.
2. "Furnish" - Means purchase new and deliver in operating order to project site.
3. "Install" - Means to physically install the items in-place.
4. "Connect" - Means make final electrical connections for a complete operating piece of equipment. This includes providing conduit, wire, terminations, etc. as applicable.
5. "Or Equivalent" - Means to provide equivalent equipment. Such equipment must be approved by the Engineer prior to bidding.

1.5 EXAMINATION OF SITE:

A. Visit the site and verify existing field conditions prior to submitting bid.

B. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.6 QUALITY ASSURANCE:

A. Perform work in accordance with all governing codes, rules, and regulations including the following minimum codes (latest editions or as otherwise accepted by the Authorities Having Jurisdiction):

1. National Electric Code (NEC)
2. International Building Code (IBC)
3. International Fire Code (IFC)
4. International Mechanical Code (IMC)
5. International Plumbing Code (IPC)
6. American Disability Act (ADA)
7. National Electrical Safety Code (NESC)
8. Local Codes and Ordinances

B. Comply with all standards where applicable for equipment and materials including the following minimum standards:

1. Underwriter's Laboratories (UL)
2. American Society for testing Materials (ASTM)
3. Certified Ballast Manufacturers (CBM)
4. Insulated Cable Engineers Association (ICEA)
5. National Electrical Manufacturer's Institute (NEMA)
6. American National Standards Institute (ANSI)
7. Electrical Testing Laboratories (ETL)
8. National Fire Protection Association (NFPA)
9. Institute of Electrical and Electronics Engineers (IEEE)
10. American Institute of Electrical Engineer's Electrical Power
11. Systems and Grounding in Commercial Construction
12. Illuminating Engineers Society (IES)

C. Provide new electrical equipment conforming to all requirements as set forth in the above standards. Provide UL labeled equipment where such label is applicable.

D. Comply with all state and local codes and ordinances. When conflicts occur among codes, standards, drawings, and/or specifications, the most stringent requirements shall govern.

E. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Provide a certificate of approval to the owner's representative from the inspection authority at completion of the work.

F. Provide only first-class workmanship from competent workers, conforming to the best electrical construction practices.

G. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.7 SUBMITTALS:

A. Shop Drawings: After the contract is awarded, but prior to manufacture or installation of any equipment, submit eight (8) complete sets of shop drawings. Partially complete sets of shop drawings are not acceptable. Submit all shop drawings in one complete submittal package. Prior to submitting shop drawings, review and certify that they are in compliance with the contract documents; Sign all approved shop drawings. Allow a minimum of two weeks for architect/engineer to review shop drawings. Refer to architectural general provision section for additional requirements.

B. Provide equipment catalog "cut sheets", brochures and/or drawings which clearly describe the proposed equipment. Include plans, elevations, sections, isometrics, and detailed engineering and dimensional information as applicable including equipment room layouts. Electrical room layouts are required to show all electrical equipment locations for all projects that include electrical rooms. Do not submit catalog sheets which describe several different items in addition to those items to be used, unless all relevant information is clearly identified. Bind each information set in three ring binder or binders of sufficient size or sizes to enclose all information. Organize all information by section. Provide separate tabbed covers for each section of Divisions 16 indicating section number for each section requiring submittals.

C. Include on front cover of binder or binders the name and location of the project, architect, electrical engineer, general contractor, electrical contractor, subcontractors, supplier/vendor, order number, volume, date, and any other applicable information. Certify that shop drawings are submitted in accordance with the contract documents with a written statement indicating compliance. Submittals will be reviewed and comments produced two times maximum. Additional reviews will be billed at current rates.

1.8 OPERATION AND MAINTENANCE MANUALS:

A. Submit four (4) complete sets of operating instruction and maintenance manuals for all equipment and materials provided under Divisions 16 prior to the Substantial Completion Inspection.

B. Provide manufacturer's recommended operating and maintenance instructions, cleaning and servicing requirements, serial and model number of each piece of equipment, complete list of replacement parts, performance curves and data, wiring diagrams, warranties, and vendor's name, address, and phone numbers. Do not submit information which describes several different items in addition to those items to be used, unless all relevant information is clearly identified. Assemble all data in completely indexed volume or volumes. Engrave the job title, and name, address, and phone numbers of the contractor on the front cover and on the spine. Incomplete O&M manuals will be returned to the contractor for corrections / additions.

1.9 RECORD DRAWINGS:

A. Maintain on a daily basis a complete set of "Red-Lined Drawings", reflecting an accurate record of all work including addendums, revisions, and changes. Indicate precise dimensioned locations of all concealed work and equipment, including concealed or embedded conduit, junction boxes, etc. Record all "Red-Lined Drawing" information on a set of full sized prints of the contract drawings.

B. Certify the "Red Lined Drawings" for correctness. Indicate on each drawing the name of the general and electrical contractors with signatures of each representative responsible for the work.

C. The electrical engineering design firm will create record (as-built) drawings from the certified red-lined drawings; however, the general and electrical contractors retain the responsibility for

the accuracy of the record drawings.

1.10 WARRANTY:

A. Ensure that the electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes and is free from electrical defects. Without additional charge, replace or repair, to satisfaction of the owner's representative, except from ordinary wear and tear, any part of the installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance or as otherwise indicated in individual sections, but in no case less than one year. Warranty incandescent and fluorescent lamps only for a period of two months from the date of substantial completion.

B. Provide complete warranty information for each item including beginning of warranty period, duration of warranty, names, addresses, and telephone numbers and procedures for filling a claim and obtaining warranty services. Written warranties and guarantees are to be submitted separately as:

1. Originals bound in a binder clearly identified with the title, "WARRANTIES AND GUARANTEES," the project name, the project number, and the Contractor's business name.

2. Electronic documents in *.pdf format.

PART 2 – PRODUCTS

2.1 GENERAL:

A. All materials shall be new and shall bear the manufacturer's name, trade name, and the approved testing laboratory such as the UL label in every case where a standard has been established for that particular material. Used materials are acceptable only if specifically indicated on drawings.

2.2 SUBSTITUTION OF MATERIALS:

A. Provide only specified products or products approved by addendum. Substitutions will be considered if two copies of the proposal is received at the architect's/engineer's office eight (8) working days prior to the bid day. Include in the proposal the specified and proposed catalog numbers of the equipment under consideration and a catalog cut sheet(s) with pictorial and descriptive information. Certify that the equipment proposed is equal to that specified, that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents.

B. It is the responsibility of the contractor to make all substituted equipment comply with the intent of the contract documents and bear all cost associated with conflicts arising form the use of substituted equipment.

C. Provide samples if so required by the architect or engineer before or after bid day.

2.3 SPARE PARTS:

A. Provide spare parts as specified in Divisions 16 sections. Deliver all spare parts to owner's representative prior to substantial completion.

PART 3 – EXECUTION

3.1 GENERAL:

A. Workmanship: Provide only first class workmanship from competent workers. Defective materials or workmanship will not be allowed on the project. Provide competent supervision for the work to be accomplished. Keep same foreman on the job, unless a change is authorized by the engineer.

B. Coordination: Prior to construction, layout electrical work and coordinate work with other trades. Sequence, coordinate, and integrate installation of materials and equipment for efficient flow of the work. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components. Coordinate with all utilities including power, communication, and data installations.

C. Provide cutting, drilling, channeling, etc. only as necessary for proper completion of the work. Do not cut structural members unless authorization is issued in writing by the architect/engineer.

D. Repairs: Repair damage to building, grounds, or utilities as a result of work under this contract at no additional cost to the owner.

E. Dimensioning: Electrical drawings indicate locations for electrical equipment only in their approximate location, unless specifically dimensioned. Do not scale electrical drawings for dimensional information. Refer to architectural drawings and shop drawings where applicable for locations of all electrical equipment. Field verify all dimension on the job site.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

G. Standards: Provide electrical installation in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

H. All workmen doing work of any nature on State of Utah projects must at all times carry their electrician's license with them and show it upon request. The acceptable ratio of apprentice to journeyman electricians on the job is 1:1.

3.2 REQUESTS FOR INFORMATION:

A. When it is clearly apparent that information is not adequately described in the construction documents or when a coordination problem exists, submit a request for information (RFI) through proper contractual channels. The electrical engineering design firm will provide a response through its contractual channel. Although verbal direction may be given to expedite changes, responses are not considered part of the contract documents until a change order has been issued and signed by the Owner or his designated representative. The Contractor shall bear all costs associated with proceeding on any change order that has not been approved by the Owner or his designated representative.

B. It is not the electrical engineering design firm's responsibility to answer questions that could clearly be answered by a thorough review of the construction documents. Should an RFI be issued by the Contractor where information was available, the electrical engineering firm will bill the contractor at the following rates:

1.	Principal	$148.00 / Hr.
2.	Engineer	$ 92.00 / Hr.
3.	Designer	$ 74.00 / Hr.
4.	Construction Administrator	$ 86.00 / Hr.
5.	Drafting	$ 54.00 / Hr.
6.	Clerical	$ 45.00 / Hr.

C. Any damages caused by construction delays due to frivolous RFI's, will be born solely by the Contractor.

3.3 SAFETY PRECAUTIONS:

A. Provide all necessary guards or construction barriers and take all necessary precautions to insure the safety of life and property.

3.4 CLEAN:

A. Clean up all equipment, conduit, fittings, wire, packing cartons, plastic, and other debris that is a direct result of the installation of the work of this division, both during the execution, and at the conclusion, of the project. Keep the site clean and safe during the progress of the work. Clean fixtures, interior and exterior of all equipment, and raceways prior to final acceptance. Vacuum interior of all electrical panels and equipment. Correct any damaged equipment. Touch-up or repaint if necessary.

3.5 TEMPORARY POWER:

A. Make arrangements with the proper institution authority for all temporary electricity.

B. Provide temporary power, complete with metering and wiring for lighting and power outlets for construction tools and equipment. Report the initial meter reading to the owner/institution, or otherwise as may be directed.

C. Service shall be provided with a main disconnect and all 20 ampere receptacles protected by 20 amp GFI, single-pole breakers. No attempt is made herein to specify construction power requirements for equipment in detail. Provide all electrical equipment and wiring as required.

D. As soon as permanent power and metering is available, the temporary power supply shall be disconnected and removed from the project site.

E. All temporary wiring shall meet the requirements of NEC Article 305 and the State Industrial Commission.

3.6 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the owner. Any electrical service interruption will be coordinated at least 7 days in advance of the power shut-off. Include all costs for overtime work in bid. Coordinate all outages and proceed only after receiving authorization from the owner's representative. Keep all outages to an absolute minimum.

3.7 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. Lost or damaged materials will be replaced at no additional cost to owner. Do not store materials and apparatus in any public thoroughfare or in any area on the site where such storage would constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.8 EXCAVATING FOR ELECTRICAL WORK:

A. Verification: Prior to excavating, locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling. Observe all State and Local codes prior to excavating. Do not disturb walls, footings, and other structural members in any way.

B. Protection: Provide barricades, warning signs, and illumination to protect persons from injury at excavations. Provide temporary coverings and heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.

C. Coordination: Do not excavate for electrical work until the work is ready to proceed without delay.

D. Excavated Materials: Temporarily store excavated materials near excavation in manner which will not interfere with or damage excavation or other work. Dispose of and remove excavated materials which are either in excess of quantity needed for backfilling or do not comply with the requirements for backfill material.

E. Burial Depths: Burial depths must comply with NEC Section 300-5 (or State of Utah requirements, whichever is more stringent), unless noted otherwise on drawings.

F. Excavation Permits: Obtain all shut-down and excavation permits as may be required for proper completion of the work.

3.9 BACKFILL MATERIALS:

A. For buried conduits or cables (other than below slab-on-grade, or concrete-encased), provide 2" thickness of well-graded sand on all sides of conduits or cables.

B. For trench backfill to within 6" of final grade, provide soil material suitable for compacting to required densities.

C. For top 6" of excavation, provide top soil.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment:

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
2. Paved Areas, other than roadways: 90 percent for cohesive soils, 95 percent for cohesionless soils.

E. Where subsidence is observable at electrical work excavations during project warranty period,

remove surface, add backfill material, compact, and replace surface treatment. Restore surface to original condition.

3.10 ROOF PENETRATIONS:

A. Where raceways and/or cables penetrate roofing, provide 26 gauge galvanized iron roof jack, sized to fit tightly to raceway and/or cable for weather-tight seal, and with flange extending a minimum of 9" under roofing on all sides. Seal opening between raceway and roof jack with approved sealant. Coordinate all work with division 7.

3.11 FIRE PENETRATION SEALS:

A. Seal all raceway and/or cable penetrations through fire-rated floors, wall, and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. Provide penetration sealants and fittings of ratings to match the rating of the penetrated materials so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the NEC.

B. Sealant Systems: Provide sealants, wall wraps, partitions, caps, and other accessories complying with UL 1479 (ASTM E-814) from the following where applicable:

1. 3M Fire Barrier Sealing Penetration System
2. Chase Foam Fire Stop System
3. Thomas and Betts Flame Safe Fire Stop System
4. Nelson Fire Stop Products

C. Fittings: Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry wall, floor, slabs, and similar structures.

D. Install sealants and fittings in accordance with all manufacturer's written instructions.

3.12 LABELING:

A. Engraved black plastic laminated, with white-core labels, 1/16" thick, shall be permanently attached on both the interior and exterior the following electrical equipment:

1. Branch panels
2. Switchgear
3. Disconnect switches
4. Motor starter and controls junction boxes (power and auxiliary)
5. Push buttons
6. Time switches
7. Transformer
8. Similar equipment.
9. Lighting contactors and associated switches
10. Junction boxes larger than 4x4x1/2.

B. The labels shall have 1/4" high, engraved letters, such as EF-1, AC-1, Panel A, etc.

C. Label for motor starters and/or thermal overload switches shall include heater size and F.L.A.

3.13 CONCRETE BASES:

A. Housekeeping Pads: Unless otherwise noted, provide 4" high reinforced concrete bases for all floor-mounted or floor-standing electrical equipment, including but not necessarily limited to the

following:

1. Transformers
2. Similar Equipment

B. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Not withstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 380-82.

C. Concrete bases: Refer to Section 16551 – exterior area lighting.

D. Transformer Pads: Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements.

3.14 TESTS:

A. Notify engineer prior to all testing specified herein at least three business days prior to testing. Engineer shall observe all tests to insure the proper operation of the electrical system.

3.15 PROJECT FINALIZATION AND START-UP:

A. Upon completion of the work, have each factory representative and/or subcontractor assist in start-up and testing of their respective systems.

B. Have each representative give personal instructions on operating and maintenance of their equipment to the owner's maintenance and/or operation personnel.

C. Have representatives certify each system with a written statement indicating that they have performed start-up and final check out of their respective systems.

3.16 FINAL REVIEW:

A. Have the project foreman accompany their reviewing parties and remove coverplates, panel covers, access panels, etc. as requested, to allow review of the entire electrical system.

END OF SECTION 16001

SECTION 16070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connections for equipment include all final electrical connections for all equipment having electrical requirements including, but not necessarily limited to the following:

1. Equipment specified under all divisions of the contract. Refer to other divisions for specific electrical requirements.
2. Owner-furnished equipment
3. Kitchen Equipment
4. Etc.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SHOP DRAWINGS: Not required.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide all materials for electrical connections including, but not necessarily limited to the following:

1. Raceways
2. Fittings
3. Conductors
4. Cords
5. Cord caps
6. Wiring devices
7. Lugs (CU-AL)
8. Electrical insulating tape
9. Heat-shrinkable tubing
10. Cable ties
11. Wire nuts
12. Other items and accessories as required.

B. Crimp on or slip-on type splicing materials designed to be used without wire stripping are not acceptable.

C. Power Distribution Blocks: Provide Square D Type LB or Equivalent.

D. Refer to other Division 16 sections for specification of electrical materials as applicable.

PART 3 - EXECUTION

3.1 GENERAL:

A. Make electrical connections in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONNECTIONS:

A. Permanently Installed Fixed Equipment:

1. Install conductors in flexible conduit from junction box to equipment control panel or connection point.
2. Where such installations are subject to moisture, install in liquid-tight flexible conduit.

B. Movable equipment:

1. Provide wiring devices, cord caps, and multi-conductor cables as required.

C. Other methods as required by the NEC and/or as required by special equipment or field conditions.

D. Power Distribution Blocks: Unless noted otherwise on drawings, provide power distribution blocks only for tapping of feeders and branch circuits. Locate in junction box or gutter in NEMA ratings to suit application.

3.3 MANUFACTURER'S INSTRUCTIONS:

A. Obtain manufacturer's instruction and wiring diagram regarding electrical connections of each piece of equipment and provide connections in accordance therewith.

3.4 VERIFICATION OF LOAD CHARACTERISTICS:

A. Verify electrical load characteristics of all equipment prior to rough-in. Review respective shop drawings of all other Divisions and Owner's equipment manuals. Report any variances from electrical characteristics noted in the contract documents to the Architect/Engineer prior to rough-in.

B. Value of rough-in work, electrical equipment, etc. installed and/or purchased by the contractor not meeting equipment requirements shall be credited back to the owner.

END OF SECTION 16070

SECTION 16072 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

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. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.
3. Construction requirements for concrete bases.

1.3 DEFINITIONS:

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS:

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
   c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the

basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE:

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

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

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 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS:

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Available Manufacturers:
   a. Cooper B-Line; a division of Cooper Industries.
   b. ERICO International Corporation.
   c. Allied Support Systems; Power-Strut Unit.
   d. GS Metals Corp.
   e. Michigan Hanger Co., Inc.; O-Strut Div.
   f. National Pipe Hanger Corp.
   g. Thomas & Betts Corporation.
   h. Unistrut; Tyco International, Ltd.
   i. Wesanco, Inc.
2. Finishes:
   a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to

MFMA-3.

3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Verify suitability of fasteners in subparagraph below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers:
      1) Hilti, Inc.
      2) ITW Construction Products.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co. Inc.
3. In the following subparagraph, use stainless steel anchors in corrosive environments.
4. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers:
      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
6. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
7. Toggle Bolts: All-steel springhead type.
8. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS:

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Available Manufacturers:
   a. Amber/Booth Company, Inc.
   b. Loos & Co., Inc.
   c. Mason Industries, Inc.
2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES:

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for raceways as within 12 inches of coupling, fitting, and box, at each 90 degrees bend, minimum of two supports per ten foot run. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps, or as otherwise required by an agency acceptable to authorities having jurisdiction.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION:

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Do not drill or core cut holes for anchors or use powder-activated fasteners in post-tension slabs, joists, and beams.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS:

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES:

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt

diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS:

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 16072

SECTION 16080 - ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to electrical demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical demolition work is indicated by drawings.

B. Electrical demolition items are shown to give a basic description of the extent of demolition work, but may not be inclusive.

C. Do not assume that the electrical drawings reflect as-built conditions. Visit and observe the project prior to submitting bid and determine extent of electrical demolition work.

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 16001 - Electrical General Provisions as applicable.

PART 2 – PRODUCTS - Not used.

PART 3 – EXECUTION

3.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Cutting work of other contractors shall be done only with the consent of that contractor. Cutting of structural members is not permitted. Repair damage to building and equipment as a result of electrical demolition work under this contract at no additional cost to owner.

B. Obtain permission from the architect before penetrating any ceiling, floor, and wall surfaces.

3.2 METHODS:

A. Disconnect and remove any/all fixtures, devices, equipment, etc. required for proper completion of the work whether shown or not.

B. Relocate, rewire, and/or reconnect any/all fixtures, devices, equipment, etc. that for any reason obstructs construction.

C. Maintain circuit integrity and continuity of all existing circuits/feeders, and systems that interfere

with or are interrupted by remodel work, unless those circuits/feeders are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduits, etc. as required.

D. Leave all existing fixtures, devices, equipment, etc. In portions of the building not being remodeled, in working condition.

E. Remove and dispose of all raceways, conductors, boxes, devices, equipment, etc., that are not to be reused. Terminate at accessible junction box by providing proper knockout closure, tape conductors, and label as "spare" with circuit no., Zone no., or other characteristic identifying source.

F. Existing raceways may be reused, if in place, where in compliance with the contract documents and the National Electrical Code. Upgrade and/or provide new conduit supports where necessary for all raceways being reused. Insure integrity of existing raceways before re-use.

G. Return to owner all light fixtures which are to be removed. Dispose of all light fixtures if so directed by owner in accordance with local environmental laws and policies. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, re-lamped, and installed as indicated. When storing fixtures for reuse, store in area and/or provide protective covering that will keep construction dust and materials off fixtures.

H. Completely remove all telephone or data cables which are to be removed back to source or as directed by owner.

I. Disconnect and remove all sound system equipment including speakers, amplifiers, etc. And return to owner. Completely remove and dispose of all associated conduit and wire.

3.3 PATCHING AND REPAIR:

A. Finished Surfaces: The electrical contractor is responsible for patching and repair of all existing interior surfaces pertaining to the installation of work under this Division, unless specifically noted elsewhere in the contract documents. Where patching and repair is necessary, surfaces shall be finished (painted, etc.) to match the adjacent materials, finished, and colors. Requirements of other Divisions such as Division 9 - finishes shall apply.

B. Hard Surfaces: Whenever excavation or trenching is required for the installation of electrical work, it shall be the responsibly of the electrical contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc. Requirements of other Divisions such as Division 2 – Existing Conditions shall apply.

3.4 CONCEALING:

A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas.

B. Surface-mounted raceways or systems shall be permitted only where approved by Architect/Engineer.

END OF SECTION 16080

SECTION 16110 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 sections making reference to conduit raceways.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the followings:

1. Rigid Metal Conduit
2. PVC Externally Coated Rigid Steel Conduit
3. Intermediate Metal Conduit
4. Electrical Metallic Tubing
5. Flexible Metal Conduit
6. Liquid-tight Flexible Metal Conduit
7. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 16001 - Electrical General Provisions as applicable. Provide conduit raceway installation in accordance with recommendations of the American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest edition.

B. Manufacturers: Firms regularly engaged in the manufacture of raceway of types and sizes required, whose products have been in satisfactory service for not less than three (3) years.

C. Shop Drawings: Not required.

PART 2 – PRODUCTS

2.1 CONDUITS:

A. Rigid Metal Conduit (RMC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in accordance with Federal Specification WW-C-0581 and ANSI C80.1.

B. PVC Externally Coated Rigid Metal Conduit: Provide hot-dipped galvanized, rigid metallic conduit externally coated with Polyvinyl Chloride (PVC) in accordance with ANSI C80.1 and NEMA Std. Pub. No. RN 1.

C. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in accordance with Federal Specification WW-C-581.

D. Electric Metallic Tubing (EMT): Provide electric metal tubing in accordance with Federal Specification WW-C-563 and ANSI C80.3.

E. Flexible Metal Conduit: Provide zinc-coated, flexible metal conduit in accordance with Federal Specification WW-C-566.

F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit, constructed of single strip, flexible continuous, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid-tight jacket of flexible Polyvinyl Chloride (PVC).

G. Rigid Non-Metallic Conduit: Provide rigid non-metallic conduit (PVC) in accordance with ANSI/NEMA TC 2, Type 1 for concrete encasement, Type 2 for direct burial.

2.2 FITTINGS:

A. Rigid Metal Conduit, Intermediate Metal Conduit, and PVC Externally Coated Rigid Metal Conduit: Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

B. Electric Metallic Tubing: Provide insulated throat, non-indenter, set screw, malleable steel fittings. Screws must have a full set. Provide concrete-tight compression-type fittings in suspended slabs. All EMT fittings shall be fabricated from steel. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable. Install OZ Type B bushings on conduits 1" and larger.

C. Flexible Metal Conduit: Provide flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 1, and Style A. Commercial "greenfield" not less than 1/2" diameter or as otherwise specified on drawings is acceptable.

D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 3, Style G.

E. Non-Metallic Conduit: Provide non-metallic conduit fittings (PVC) in accordance with ANSI/NEMA TC 3 to match conduit types and materials.

F. Expansion Fittings: OZ Type AX, or equivalent to suit application.

G. Sealing Bushings: Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ Type CSB internal sealing bushings.

H. Cable Supports: Provide OZ cable supports for vertical risers, type as required by application.

2.3 SIZES:

A. Provide conduits in sizes as indicated in contract documents or as otherwise specified herein, but not less than 3/4".

PART 3 – EXECUTION

3.1 GENERAL:

A. Install raceway and accessories in accordance with manufacturer's written instructions,

applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 LOCATIONS:

A. Rigid Metal Conduit and Fittings: Use for conduit bends greater than 22 degrees where buried below grade or slab on grade. Install RMC where raceway passes vertically through slab-on-grade. Where raceways penetrate building, manholes, or vault walls and floors below grade, provide RMC for a minimum distance of 10' on the exterior side of the floor or wall. Use RMC for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.

B. Intermediate Metal Conduit and Fittings: Use for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.

C. Electric Metal Tubing and Fittings: Use for above-grade feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Install in suspended slabs subject to local code requirements and fire rating considerations.

D. Flexible Metal Conduit and Fittings: Use as whips for lighting fixtures, fixed equipment where not exposed to weather of moisture, other devices where required by NEC, and as requested by the Engineer. Maximum length not to exceed 6', unless specifically approved by the Electrical Engineer.

E. Liquid-Tight Flexible Metal Conduit and Fittings: Use for connection to motor terminal boxes, fixed equipment where subject to moisture or weather, and other equipment subject to movement or vibration. Maximum length not to exceed 6', unless specified otherwise.

F. Rigid Non-Metallic Conduit and Fittings: Use for below-grade service entrances, feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Do not use above grade.

3.3 METHODS:

A. Maintain a minimum of 12" clearance between steam or hot water lines or other hot surfaces. Where such clearance is impractical, insulate conduit with approved materials.

B. Install conduits parallel with or at right angles to lines of the structure. Route conduits symmetrically where possible.

C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.

D. Precaution shall be exercised to prevent accumulation of water, dirt or concrete in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.

E. Any conduit which pierces airtight spaces or plenums shall be sealed to prevent air leakage with mastic acceptable to the Architect.

3.4 CONCEALING:

A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas. In equipment rooms, if lighting raceways are run exposed, installation shall not be done until piping and duct work layout has been determined in order that lighting boxes may be located so as to avoid being covered by overhead ducts and piping. If lighting raceways in equipment rooms are concealed in the structural ceiling slab, after mechanical work is complete, exposed conduit extensions shall be run to locate lighting fixtures where they are not obscured by work of other trades.

3.5 BURIED CONDUITS:

A. Comply with all burial depths as defined in NEC Section 300-5. Bury all conduits at least 24" below grade, unless specifically indicated otherwise on drawings. Provide magnetic 6" wide "Yellow Warning" ribbon 12" directly above conduit and 6" below finished grade measured from the top of the conduit or duct bank. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single marker.

B. Slope all conduits toward manholes or pull boxes for proper drainage. Use weep holes. Gravel drainage pockets are not permitted.

C. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.

D. Under Concrete Slab on Grade: Horizontal conduit must be installed a minimum of 2" below the bottom of the concrete slab. Conduits should not be installed in concrete slabs.

E. Concrete Encasement: Where concrete-encasement is indicated on drawings, provide ductbank construction using red 3000 psi at 28 day strength concrete. Provide minimum 4" cover on all sides of exterior conduits. Provide conduit spacers where applicable. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.

F. Where conduits are extended for future use, cap and clearly mark.

3.6 ELECTRICAL CONTINUITY:

A. Provide electrically continuous conduit systems throughout.

3.7 FIELD CUTS AND THREADS:

A. Cut all conduits square. Remove all sharp or rough edges and ream all burrs, inside and outside. Provide clean sharp threads on RMC and IMC.

B. Engage at least five full threads on all RMC and IMC fittings. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.8 SUSPENDED SLABS:

A. When conduit is installed in the suspended slab, it shall be limited to conduits having a diameter of 1" (25 mm) or less, or less than 1/3 the concrete cover, and no crossovers occur, and conduit spaced at least 18" (450 mm) apart with a 3/4" (20 mm) cover.

3.9 CONDUIT ENDS:

A. Cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

3.10 SPARE CONDUITS:

A. Provide five (5) 3/4" empty conduits from panel stubbed into accessible ceiling space and five (5) 3/4" conduits into accessible floor space. When floor is not accessible, provide six (6) 3/4" empty conduits from panel stubbed into accessible ceiling space. Cap and label all conduits.

B. Install a 200 lb. polypropylene pull cord in each empty conduit run.

3.11 HAZARDOUS LOCATIONS:

A. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

3.12 CLEANING:

A. Pull mandril and swab through all conduits before installing conductors.

END OF SECTION 16110

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to conductors and cables.

1.2 DESCRIPTION OF WORK:

A. This section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors.

C. Applications for conductors and cables required for project include:

1. Electrical service.
2. Feeders.
3. Branch Circuits.

1.3 SUBMITTALS:

A. Product Data: For each type of conductor and/or cable indicated.

B. Field Quality-Control Test Reports: From Contractor. Refer to Section 16001 – General Electrical Provisions.

1.4 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Manufacturers: In other Part 2 articles where subparagraph titles below introduce lists, provide products by the manufacturer specified, subject to compliance with requirements.

B. Ambient Conditions: Conductors used for branch circuits in areas where the ambient conditions exceed 30 degree C. shall be provided with insulation approved for that temperature.

C . Wire Sizes: As indicated on electrical drawings or as specified herein, but in no case less than No. 12 AWG.

2.2 COPPER CONDUCTORS:

A . Manufacturers:

1. American Insulated Wire Corporation; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B . Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.

C . References and Ratings:

1. ICEA S-95-658 / NEMA WC70.
2. ASTM.
3. UL Standard 83.
4. UL Standard 1063 (MTW).
5. Federal Specification J-C-30B.
6. NEC.

D . Conductor Material: Copper.

E . Stranding: Solid conductor for No. 12 AWG, stranded for No. 10 AWG and larger.

F . Conductor Insulation Types: Thermoplastic-insulated, Type THHN / THWN-2.

2.3 CONNECTORS AND SPLICES:

A . Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B . Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C . Splices for wire sizes #10 and smaller shall be screw-on type similar to scotch or ideal wing nut connectors. Crimp-on splices designed to be used without wire stripping are not acceptable.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install conductors, cables, and accessories as indicated, in compliance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standards of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONDUCTOR AND CABLE APPLICATIONS:

A. Service Entrance: As indicated on the electrical drawings.

B. Feeders: As indicated on the electrical drawings.

C. Branch Circuits:

1. Exposed, including in crawlspaces: Copper conductors in raceway.
2. Concealed in ceilings, walls, and partitions: Copper conductors in raceways.
3. Concealed in concrete and below slabs-on-grade: Copper conductors in raceway.

D. Cord Drops, Reels, and Portable Appliance Connections: Flexible cord.

E. Class 1 Control Circuits: Copper conductors in raceway.

3.3 INSTALLATION:

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. When raceway is not required, install concealed cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.

E. Support cables according to other applicable specification sections.

F. Seal around cables penetrating fire-rated elements to comply with applicable fire stop specification sections.

G. Color Coding: Color code secondary service, feeder, and branch circuit conductors. Colors shall remain consistent throughout the project and shall match existing coding system where applicable.

1. Conductor sizes No. 6 AWG and smaller: Colored insulation.
2. Conductors sizes No. 4 AWG and larger: 2 inch (51 mm) band of Colored adhesive marking tape applied at all terminations, junction boxes, and pull boxes.
3. Branch circuit switched-legs and travelers: Colored insulation (in colors other than those indicated below).
4. Color-code 120/208V system conductors:
   a) Phase A: Black.
   b) Phase B: Red.
   c) Phase C: Blue.
   d) Neutral: White.
   e) Ground: Green.
   f) Isolated Ground: Green with yellow tracer.

3.4 HOMERUN CIRCUITS:

A. Homerun circuits may be combined in common conduits at the option of the contractor in compliance with the following:

1. Three-Phase Installations: Not more than three single-phase circuits with common neutral in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a, b, or c).
2. Single-Phase Installations: Not more than two single-phase circuits with common neutral in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a or b).

3.5 NEUTRAL CONDUCTORS:

A. LIGHTING CIRCUITS: Where multiple circuits serving lighting are run in a single raceway (see paragraph above for allowable number or circuits per conduit), a common neutral shall be allowed. When any one circuit is serving fluorescent lighting loads, provide an oversized neutral conductor. Size the neutral conductor one size (AWG) larger than the largest phase conductor.

B. OUTLET CIRCUITS: Where multiple circuits serving electrical outlets are run in a single raceway (see paragraph above for allowable number of circuits per conduit), a shared common neutral is allowed.

3.6 VOLTAGE DROP:

A. Provide branch circuit conductors in sizes such that voltage drop for branch circuits do not exceed 3 percent at the farthest outlet. Provide service, feeder, and branch circuit conductors so that the voltage drop on the entire electrical system does not exceed 5 percent at the farthest outlet. This shall be strictly followed regardless of the conductor sizes indicated on the electrical drawings. Increase conductor sizes (and conduits where necessary to comply with NEC conduit fill requirements) as necessary to accommodate this requirement. Calculations shall be based on the following:

1. Lighting Branch Circuits: Connected load plus 25% spare.
2. Appliance and Equipment Branch Circuits: Nameplate or NEC required load.
3. 120V Convenience Outlet Branch Circuits: 12 amps minimum, but in no case less than NEC loading requirements. Use the following schedule:

Distance (feet)	Wire Size (AWG)
0-80	#12
81-125	#10
126-200	#8
201-320	#6

4. Use the Bussmann method to calculate voltage drop.

3.7 CONNECTIONS:

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack. Use

pig tails when wiring outlets.

3.8 FIELD QUALITY CONTROL:

A. Testing: Perform the following field quality-control testing:

1. Visual and Mechanical Inspection:
   a) Inspect cables for physical damage and proper connection in accordance with the electrical construction documents.
   b) Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench.
   c) Check cable color coding for compliance with electrical specifications.
2. Electrical Tests:
   a) Perform insulation resistance test on each conductors for feeders 100 amps and greater with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   b) Perform continuity test to insure proper cable connection.
3. Test Values:
   a) Minimum insulation resistance values shall not be less than two megohms.

B. Test Reports: Prepare a written report and submit to the Electrical Engineer at the completion of the project. The report shall include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to electrical boxes and fittings.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical boxes and fittings work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Conduit Bodies
5. Bushings
6. Locknuts
7. Knockout Closures
8. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 16001 - Electrical General Provisions as applicable.

B. Manufacturers: Firms regularly engaged in the manufacturer of boxes and fittings required, whose products have been in satisfactory service for not less than three years.

C. Shop Drawings: Submit shop drawings on floor boxes only where required.

PART 2 - PRODUCTS

2.1 INTERIOR OUTLET BOXES:

A. General: Provide one piece, galvanized or cadmium-plated, flat-rolled, sheet steel interior outlet boxes of types, shapes, and sizes to suit respective location and installation. Construct with stamped knockouts on back and sides and with threaded screw holes. Provide corrosion-resistant screws for securing boxes, covers, and wiring devices. Size all junction boxes in accordance with NEC Table 314.16(A), with a minimum box size of 4" x 4" x 1-1/2". Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16". Gangable boxes shall not be used.

B. Switch, Telephone, and Receptacle Outlets: Provide outlet boxes not less than 4" square, with adapting tile or plaster covers where necessary to set flush with finished surfaces. Where three

raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Gang boxes shall be used where more than one switch or device is located at one point. Sectional Boxes are not acceptable. In masonry walls where tile or plaster ring cannot be used, install a single-gang 3-1/2" deep box minimum, unless otherwise noted. Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".

C. Lighting Outlets:

1. Lay-in Grid: Outlets for recessed fixtures in acoustical tile ceilings shall be located to center on a single tile or at the intersection of four tiles.
2. Surface-mounted: Provide 4" square octagonal outlet boxes for surface-mounted, ceiling fixture outlets. Mount each box independently of the conduit on standard 3/8" stud or approved box hangar where applicable. Include backing and supports as required to carry 200 lbs. Where three or more raceway entrances are made, use a minimum box depth of 2-1/8".

2.2 WEATHERPROOF OUTLET BOXES:

A. Provide corrosion-resistant, cast-metal weatherproof outlet boxes, of types, shapes, and sizes, with threaded conduit ends, cast metal coverplates with spring-hinged waterproof caps, face plate gaskets, and corrosion-resistant fasteners.

2.3 JUNCTION AND PULL BOXES:

A. Provide code-gauge sheet steel junction and pull boxes, with removable screw-on covers and welded seams, of types, shapes, and sizes to suit each respective location and installation. Size all junction and pull boxes in accordance with NEC 314.28. Provide stainless steel nuts, bolts, screws, and washer.

2.4 FLOOR BOXES:

A. Provide steel or PVC, weatherproof, concrete-tight floor boxes of types, shapes, and sizes to suit each respective location and installation. Where multi-service floor boxes are indicated, provide floor boxes sized to accommodate wiring devices and communication outlets shown on drawings. Construct floor boxes with fully adjustable leveling screws, and knockouts as required to accommodate specified conduits.

B. Provide floor boxes from the following manufacturers:

1. Bell Electric
2. Crouse-Hinds
3. Hubbell
4. Steel City
5. Thomas&Betts
6. Wiremold

2.5 CONDUIT BODIES:

A. Provide galvanized, cast-metal conduit bodies of type, shapes, and sizes to suit respective locations and installation. Construct with threaded conduit entrance ends and removable covers. Provide corrosion-resistant screws.

B. Aluminum boxes and fitting shall not be permitted.

2.6 CONDUIT CONNECTIONS:

A. Box connectors 3/4" and larger shall be insulated, throat-type or equal type plastic bushings. Provide double locknuts and insulating plastic bushings for RMC and IMC terminating at panels and boxes.

B. Where RMC penetrates building, manholes, or vault walls and floors below grade, provide sealing bushings with external membrane clamps as applicable. Provide segmented internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway. Where RMC terminates in manhole, vault, or pull box, provide insulated grounding bushings. Also see Section 16135 – Electrical Boxes and Fittings.

C. Install OZ type "B" connectors for all conduits 1" and larger.

D. Provide cable supports in all vertical risers in accordance with NEC 300-19.

2.7 EXPANSION FITTINGS:

A. Provide expansion joint fittings in all conduit runs crossing structural expansion joints, whether above-grade, in slab-on-grade, or in suspended slabs. Provide OZ type "AX" or approved equivalent, size to the raceway.

2.8 ACCESSORIES:

A. Provide all accessories including, but not necessarily limited to, bushings, knockout closures, locknuts, offset connectors, etc. of types, shapes, and sizes to suit respective locations and installation. Construct of corrosion-resistant steel.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install electrical boxes and fittings in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 METHODS:

A. Where outlet boxes are subject to weather or moisture, install weatherproof outlet boxes.

B. Remove knockouts only for entering conduits. Provide knockout closures to cap unused knockout holes where blanks are mistakenly removed.

C. Do not use condulets in place of elbows or junction boxes. Condulets in sizes 2" or larger shall not be used, unless specifically approved by the electrical engineer.

D. Install boxes and conduit bodies in readily accessible locations. Install recessed boxes with faces of boxes or rings flush with finished surfaces. Seal all openings between outlet box and adjacent surfaces with plaster, grout, or similar suitable material.

E. For stud construction, install boxes with rigid supports using metal bar hangers, or 2" X 4", 1" X 6" wood bridging between studs with screws. Welding or nailing boxes directly to metal joist

and studs is not acceptable. Boxes set opposite in common wall shall have at least 10" of conduit between them. Securely fasten outlet boxes to structural surfaces to which attached.

F. For concrete or masonry construction, solidly embed electrical boxes in concrete and masonry. Provide box supports as required to keep outlet boxes flush with finished surfaces.

G. Coordinate location of all outlet boxes with millwork, back splashes, tackboards, etc.

H. Install junction boxes or condulets in conduit runs as required at 100 foot maximum intervals on long runs. This shall apply to concrete junction boxes in grade and junction boxes within the building.

I. Provide electrical connections for installed boxes.

3.3 IDENTIFICATION:

A. Mark circuit number on exterior side of junction boxes located in ceilings such that circuits numbers are readily identifiable. For outlet boxes in wall, mark circuit numbers on interior sides of outlet boxes.

B. Identification labels shall be as follows:

Normal Power	Black with White letters
Emergency Power	Red with White Letters
UPS	Orange with White Letters

END OF SECTION 16135

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to wiring devices.

1.2 DESCRIPTION OF WORK:

A. Extent of wiring device work is indicated by drawings and schedules.

B. Types of electrical wiring devices in this section include the following:

1. Toggle Switches
2. Receptacles
3. Occupancy Sensors

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SHOP DRAWINGS:

1. Submit manufacturer's data on all electrical wiring devices.
2. Where occupancy sensors are required, provide scaled drawing showing manufacturer's recommended locations.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA standards Pub No. WD 1. nylon construction, 20 amp rating minimum.

B. Provide wiring devices in colors selected by Architect/Engineer. Provide red receptacle outlets and toggle switches where devices are circuited to emergency power. Provide orange receptacle outlets where devices are circuited to UPS power.

2.2 TOGGLE SWITCHES:

A. Provide toggle switches from one of the following manufacturers (Fed-Spec):

Manufacturer	1-Pole	3-Way	4-Way	W/Pilot
Hubbell	HBL1221	1223	1224	1221-PL

Pass & Seymour	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	1221	1222	1223	1221-PLR
Cooper	2221	2223	2224	2221-PL
Bryant	4901	4903	4904	4901-PL

B. Abbreviations are defined as follows:

1. 1-Pole - Single-Pole Toggle Switch
2. 3-Way - Three-Way Toggle Switch
3. 4-Way - Four-Way Toggle Switch
4. W/Pilo - Single-Pole Toggle Switch with Pilot Light

C. Must be back and side wired, and have color-coded covers, Brass terminal screws, back wire ground clamp, and self-grounding clip.

2.3 RECEPTACLES:

A. Provide duplex receptacles from one of the following manufacturers:

Manufacturer	CO	GFCI	IG
Hubbell	5362	GF5362	5362IG
Pass & Seymour	5362	2091-S	IG6300
Leviton	5362	8899	5362-IG
Cooper	5362	VGF20	IG5362
Bryant	5362	GFR53FT	5362IG

B. Abbreviations are defined as follows:

1. CO- Convenience Outlet Duplex Receptacle
2. GFCI- Ground Fault Circuit Interrupter duplex Receptacle
3. IG- Isolated Ground Duplex Receptacle

2.4 COVERPLATES:

A. Wall Plates: Provide coverplates for all wiring devices. In all finished areas, provide nylon or high impact resistant thermoplastic coverplates in colors as selected by Architect. Provide red coverplates for all receptacle outlets and toggle switches that are circuited to emergency power. Provide orange coverplates for all isolated ground receptacle outlets. Provide stainless steel coverplates in commercial kitchens and food preparation areas. Provide ganged coverplates for all switches and/or dimmers. Provide pre-marked coverplates for special purpose outlet indicating voltage, amperages, and phase. Provide raised stamped, galvanized, steel plates in all unfinished areas. Provide weather-proof coverplates for outlets exposed to weather and moisture.

B. Weather-Protecting Device Enclosure: Where required for compliance with NEC 410-67 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

1. Intermatic WP1020 or WP1030
2. Hubbell WP826MP
3. Pass & Seymore

2.5 OCCUPANCY SENSORS:

A. General: Provide self-contained, ultrasonic motion detectors providing volumetric coverage without gaps within the detection area. Provide sensors in voltage and wattage ratings required to suit application. Provide sensors from one of the following manufacturers:

1. Lithonia
2. Novitas
3. The Watt Stopper
4. Hubbell
5. Leviton

B. Occupancy sensors specified on drawings are manufactured by the Watt Stopper. The manufacturers indicated above are acceptable provided that they meet the functional performance of those specified. Prior approval for these manufacturers is not required; however, if it is determined that the proposed occupancy sensors do not meet functional performance of the specified occupancy sensors, the Contractor shall provide the specified occupancy sensors at no additional cost to Owner.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install wiring devices and accessories in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to insure that products fulfill requirements.

3.2 METHODS:

A. Install wiring devices only in electrical boxes which are clean and free from excess building materials, dirt, and debris. Do not install wiring devices until painting work is completed.

B. Replace receptacles and/or coverplates which are damaged, stained, or burned.

3.3 GFCI RECEPTACLES:

A. Provide separate neutral conductor from panel to each GFCI receptacle circuits.

B. Install GFCI receptacles for all receptacles installed in restrooms, outdoors, or within six feet of any sink. All receptacles in kitchens shall be GCFI protected.

C. Do not wire standard receptacles on the load side of GFCI receptacle - Install GFCI receptacles.

3.4 OCCUPANCY SENSORS:

A. Do not locate immediately adjacent to air diffusers. Coordinate exact placement with Division 15.

3.5 GROUNDING:

A. Provide electrical continuous, tight, grounding connections for wiring devices.

3.6 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

3.7 IDENTIFICATION:

A. All devices shall be identified on the coverplate with panelboard name and circuit number.

B. In each outlet, tag each wire to identify the circuit it serves.

C. Identification labels shall be as follows:

Normal Power	Black with White letters

END OF SECTION 16140

SECTION 16155 - MOTOR STARTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to motor starters.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Type of motor starters in this section include the following:

1. Fractional Horsepower Manual Starters

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Shop Drawings: Submit manufacturer's data and dimensional details on motor starters including voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Manufacturers: Subject to compliance with all requirements, provide products of on of the following:

1. Allen Bradley
2. Cutler-Hammer
3. General Electric
4. Siemens
5. Square D

B. Maintenance, Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 3 units of each, for both power and control circuit fuses.

2.2 THERMAL OVERLOAD UNITS:

A. Provide metal alloy, thermal overload units for all motor starters. Size to actual running full load current, not to motor plate current, after air and water balancing are completed.

2.3 FRACTIONAL HORSEPOWER MANUAL STARTERS:

A. Provide fractional horsepower manual starters for single-phase fractional horsepower motors up to and including 1 horsepower, equivalent to Square D Class 2510, Type F, of types, sizes, and electrical characteristics required to suit applications or as otherwise indicated on drawings. Provide NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage starter, with thermal overload units, red pilot light, and toggle operator with handle guard/lock-off. Provide ANSI/NEMA ICS 6, Type 1 enclosures, or where subject to weather or moisture, Type 3R.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install motor starters in accordance with manufacturer's written instructions, applicable requirements of the NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices.

3.2 METHODS:

A. Install overload units so catalog number is visible. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

B. Where sizes of starters, disconnect, fuses, motor circuit protectors, heaters, etc. are not indicated on drawings, size all equipment in accordance with manufacturer's written instructions.

C. Submit with the record drawings a record of the motor amperage readings of each electrically-driven unit; show horsepower, full-load amps and service factor.

3.3 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each starter cabinet. Provide red plastic laminate label for starter supplied by emergency power. Include mechanical equipment designation, horsepower, voltage, full-load amps, and service factor of motor. Mark on interior cover the source of power by indicating the panel and circuit number.

3.4 MOTOR CONNECTIONS:

A. Each motor shall be connected to the conduit with a length of flexible, seal-tight conduit (minimum of 18"), with proper type fittings. All motor supply circuits shall include a green ground conductor. Check for proper motor rotation on all motors or equipment.

END OF SECTION 16155

SECTION 16160 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to panelboards.

1.2 DESCRIPTION OF WORK:

A. Extent of panelboard work is indicated by drawings and schedules and is specified herein.

B. Type of panelboards in this section include the following:

1. Lighting and Appliance Panelboards
2. Power Distribution Panelboards

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures. Include schedule of devices, including, but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.
2. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with all requirements, provide products from one of the follows:

1. Cutler-Hammer, Eaton Corp.
2. General Electric Co.
3. Siemens Energy & Automation, Inc.
4. Square D Co.

2.2 GENERAL:

A. Provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated. Provide overcurrent protective devices, etc. as indicated on drawings for a complete installation.

B. Where "Spaces" or "Blanks" are indicated on panelboard schedules, provide drilled bus and mounting hardware ready to receive breaker or fusible switch of size indicated on panelboard schedule.

2.3 PANELBOARD ENCLOSURES:

A. Provide Code gauge, galvanized or rust-resistant sheet steel enclosures in sizes and NEMA types to suit respective applications. The size of the wiring gutters and gauge of steel shall be in accordance with the latest NEMA Standards Publication and latest UL standards for panelboards. Flush locks shall not protrude beyond the front of the door. Key all enclosures alike and provide three keys at completion of the project. Fronts shall have adjustable indicating trim clamps, which shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card, with clear plastic covering shall be provided on the inside of the door. The directory cards shall be typewritten to identify each circuit service. Provide panel enclosures with doors hinged to enclosures. Provide ANSI-61 painted finish.

2.4 LIGHTING AND APPLIANCE PANELBOARDS:

A. Provide dead-front, safety-type lighting and appliance panelboards of types and electrical characteristic indicated. Provide aluminum bus bars, full-sized neutral bus, and ground bus. Provide insulated/isolated ground buses where indicated. Include overcurrent protective devices and switches in quantities, ratings, types, and arrangements shown. See Section 16180 - Overcurrent Protective Devices.

B. Rate devices, bussing, supports, etc. equal to or greater than the short circuit current rating indicated. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

2.5 POWER DISTRIBUTION PANELBOARDS:

A. Provide dead-front, safety-type lighting and appliance panelboards of types and electrical characteristic indicated. Provide wall-mounted or floor-standing power distribution panelboards as indicated. Provide panelboards suitable for use as service equipment where required. Provide aluminum bus bars, full-sized neutral bus, and ground bus. Provide insulated/isolated ground buses where indicated. Include overcurrent protective devices and switches in quantities, ratings, types, and arrangements shown. See Section 16180 - Overcurrent Protective Devices.

B. Rate devices, bussing, supports, etc. equal to or greater than the short circuit current rating indicated. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install panelboards in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on both the interior and exterior of each panelboard enclosure indicating name of panelboard. Bolt and nut or rivet labels to enclosure. (Sheet metal screws are not acceptable).

1. This label shall also indicate the feeder circuit. Mark on interior cover the source of power by indicating the panel and circuit number.

B. All subpanels shall be labeled to identify the main panel that supplies the feeder circuit.

C. Provide red plastic laminate label for panelboards supplied by emergency power.

D. Provide orange plastic laminate label for panelboards supplied by UPS power.

3.3 MOUNTING:

A. Mount panelboards as indicated, but in no case higher than 6'-6" from finished floor to top of panel. Anchor enclosures firmly to walls and structural surfaces.

B. Provide 4" high concrete pad under floor-standing power distribution panelboards.

3.4 CIRCUIT DIRECTORIES:

A. For lighting and appliance panelboards, provide typed panelboard circuit directories. Indicate load description or name and location. Utilize actual building room numbers, not architectural room numbers used on drawings. Label the panel and circuit that feed this panel.

B. For power distribution panelboards, provide 1/16" thick black plastic laminate labels with 1/4" high lettering for each load served.

1. Provide red plastic laminate label for emergency loads.
2. If circuits are changed in a panel, type the new circuit designation and glue on existing circuit directory. Do not discard existing panelboard schedule unless all circuits have been changed.

3.5 WIRING METHODS:

A. Arrange conductors neatly within enclosure, and secure with suitable nylon ties.

B. Panelboards shall not be used for junction or splicing boxes or as a raceway.

3.6 ARRANGEMENT OF OVERCURRENT PROTECTIVE DEVICES:

A. The overcurrent protective devices shall be in the same sequence and labeled as the panel schedule on the drawings.

END OF SECTION 16160

SECTION 16170 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to disconnect switches.

1.2 DESCRIPTION OF WORK:

A. Extent of disconnect switch work is indicated by drawings and schedules and is specified herein.

B. Type of disconnects in this section include the following:

1. Heavy Duty Disconnect Switches

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Product Data: Submit manufacturer's data on disconnect switches including specifications, installation instructions, etc.
2. Shop Drawings: Submit dimensioned drawings of disconnects showing accurately scaled layouts of disconnects and enclosures.
3. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with all requirements, provide disconnect switches (fusible and non-fusible) and fusible switches (in power panels) from one of the following:

1. Cutler-Hammer
2. General Electric
3. Siemens
4. Square D

2.2 GENERAL:

A. Provide fusible and/or non-fusible disconnect switches and ancillary components of types, sizes, ratings, and electrical characteristics as indicated. Provide enclosures in NEMA ratings

suitable for applications. Provide fuses as indicated; See Section 16180 - Overcurrent Protective Devices.

2.3 HEAVY DUTY DISCONNECT SWITCHES:

A. Provide 600 volt rated, heavy duty switches in sheet steel enclosures as indicated of types, sizes, ratings, and electrical characteristics indicated and as required to suit respective application. Provide heavy duty switches for circuits rated greater than 240 volts, but less than 600 volts. Construct of spring-assisted, quick-make, quick-break mechanisms. Provide solid neutral as required by application. Equip with operating handle capable of being locked in the OFF position. Provide Class R rejection fuse clips for fusible-type switches.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install disconnects in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect indicating name of disconnect or load served. Bolt labels to enclosure. Mark on interior cover the source of power by indicating the panel and circuit number.

B. Provide red plastic laminate label for disconnects supplied by emergency power

3.3 MOUNTING:

A. Mount disconnects as indicated, but in no case higher than 6'-6" from finished floor to top of disconnect. Anchor enclosures firmly to walls and structural surfaces.

B. Provide 4" high concrete pad under floor-standing disconnects.

END OF SECTION 16170

SECTION 16289 - TRANSIENT VOLTAGE SUPPRESSION

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 TVSSs for low-voltage power.

B. Related Sections include the following:

1. Division 16 Section "Panelboards" for factory-installed TVSSs.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient Voltage Surge Suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:

1. UL 1283.
2. UL 1449 2nd Edition.
3. UL 281-1 (fuse)
4. CSA 22.2.
5. NEMA LS-1

C. Manufacturer Seismic Qualification Certification: Submit certification that transient voltage suppression devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Products Testing: For transient voltage suppression devices, provide the following product test data:

1. Provide actual let through voltage test data in the form of oscillograph results for the ANSA/IEEE C62.41 Category C3 & C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.
2. Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the device noise attenuation equal or exceeds 50 db at 100 kHz.
3. Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying that suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

E. Field quality-control test reports, including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

F. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI/IEEE C62.41.1-2002, "IEEE Guide for Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits," IEEE C62.41.2-2002, "IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45-2002, "IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."

C. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

D. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 2nd Edition, "Transient Voltage Surge Suppressors."

E. The manufacturer shall by ISO 9000 certified.

F. Comply with FIPS Pub 94.

G. Comply with NEC 2002, Article 285, "Transient Voltage Surge Suppression TVSSs".

1.6 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.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: -40 to 140 deg F (-40 to 60 deg C).
3. Humidity: 5 to 95 percent, non-condensing.
4. Altitude: Up to 20,000 feet (6090 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance. Coordinate placement of breakers in electrical panelboards feeding field-mounted surge suppressors so that conductor leads are kept to an absolute minimum.

B. Coordinate surge protection devices with Division 16 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology, Inc.
2. Cutler-Hammer, Inc.; Eaton Corporation.
3. EFI Electronics
4. General Electric Company.
5. LEA International.
6. Leviton Mfg. Company Inc.
7. Liebert Corporation; a division of Emerson.
8. Siemens Energy & Automation, Inc.
9. Square D; Schneider Electric.
10. United Power Corporation.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The

system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes – For a wye-configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
5. UL 1449 2nd Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 2nd Edition SVR for the device must not exceed the following:
   a. 208Y/120 V:
      1) L-N; L-G; N-G: 400 V.
      2) L-L: 800 V.
6. ANSI/IEEE Cat. C3 Let Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:
   a. 208Y/120 V L-N: 560 V.
7. ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:
   a. 208Y/120 V L-N: 160 V.

B. TVSS Design

1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.
2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.
3. Extended Range Filter – The Surge Protective Device shall have a High Frequency Extended Range Tracking Filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies:
   a. Insertion Loss (ratio):
      1) 50kHz: 40
      2) 100kHz: 316
      3) 500kHz: 316
      4) 1MHz: 89
      5) 10MHz: 200
      6) 100MHz: 79
   b. Insertion Loss (dB):
      1) 50kHz: 32
      2) 100kHz: 50
      3) 500kHz: 50
      4) 1MHz: 39
      5) 10MHz: 46
      6) 100MHz: 38
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
5. Standard Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:
   a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light shall

indicate which phase(s) have been damaged.

b. Contacts for Remote Status Monitoring – The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

6. Overcurrent Protection Fusing: In order to isolate the TVSS under any fault condition, the manufacturer shall provide:
   a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events. TVSS shall safely reach an end-of-life condition when subjected to fault current levels between 0 and 200 kA, including low level fault currents from 5 to 5000 amperes.
   b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A,
   c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 2002:

1. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50 microseconds, 20kV open circuit voltage. 8 x 20 microsecond, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:
   a. Service Entrance: 5000 impulse per mode.
   b. Distribution Locations: 5000 impulse per mode.
   c. Branch Locations: 5000 impulse per mode.

2.3 SYSTEM APPLICATION

A. Locations – Electrical drawings indicate the location and IEEE Category requirements of all required TVSS's.

B. Surge Current Capacity – The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as follows:

1. IEEE Category "C" Locations:
   a. Per Phase: 240kA.
   b. Per Mode: 120kA.
2. IEEE Category "B" Locations:
   a. Per Phase: 150kA.
   b. Per Mode: 80kA.
3. IEEE Category "A" Locations:
   a. Per Phase: 100kA.
   b. Per Mode: 60kA.

C. Lighting and Appliance Panelboard Requirements – Any one of the following options are acceptable:

1. Factory-Installed TVSS Option:
   a. The TVSS shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-

feed breaker options.

b. The TVSS shall be immediately installed on the load side of the main breaker or main lugs.
c. The panelboard shall be capable of re-energizing upon removal of the TVSS.
d. A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.
e. The TVSS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device in not acceptable). TVSS units that use a cable connection do not meet the intent of this specification. For this option, the breaker shown on the electrical drawings shall be deleted.
f. The TVSS shall be included and mounted within the panelboard by the manufacturer of the panelboard.
g. The TVSS shall be of the same manufacturer as the panelboard.
h. The complete panelboard including the TVSS shall be UL67 listed.

D. Power Distribution Panelboard Requirements –The following option is acceptable:

1. Factory-Installed TVSS Option:
   a. The TVSS shall be of the same manufacturer as the power distribution panelboard, motor control center, or switchboard.
   b. The TVSS shall be factory installed inside the power distribution panelboard, motor control center, or switchboard at the assembly point by the original equipment manufacturer.
   c. Locate suppressor on load side of main disconnect device or main lugs, as close as possible to the phase conductors and ground/neutral bar.
   d. Provide a disconnect sized in accordance with all manufacturer's recommendations. The disconnect shall be directly integrated to the suppressor and assembly bus by using bolted bus bar connections. The disconnect is the preferred method. If otherwise recommended by the manufacturer, provide a multi-pole circuit breaker in the panelboard in size as recommended by the manufacturer to feed the surge suppressor. The size of the breaker shall supersede the size of the breaker shown on the electrical drawings. Provide copper conductors in size as recommended by the manufacturer for connecting the phases, neutral, and ground between the surge suppressor and the circuit breaker in the panelboard. The size of the conductor shall supersede the size of the conductors shown on the electrical drawings.
   e. The TVSS shall be integral to power distribution panelboard, motor control center, or switchboard as factory standardized design.
   f. All monitoring diagnostics features shall be visible from the front of the equipment.

2.4 ENCLOSURES

A. Provide enclosures suitable for locations as indicated on the drawings or as described below:

1. NEMA 1/3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids. (Panelboards Only)
3. NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Unites Only)

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground at TVSS.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect electrical equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field tests and inspections and prepare test reports:

1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 1 Section "Closeout Procedures" or "Demonstration and Training" as may be applicable.

END OF SECTION 16289

SECTION 16452 – GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to grounding.

1.2 DESCRIPTION OF WORK:

A. Extent of grounding work is indicated by drawings and schedules and is specified herein.

B. Ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, equipment, and separately derived systems in accordance with the NEC and all other applicable codes to provide a permanent, continuous, low impedance, grounding system.

C. Provide grounding system such that the resistance from the service entrance ground bus, through the grounding electrode to earth is not greater than 5 ohms.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. TESTING: Submit results of ground resistance testing as specified in this section. Include name of testing agency with report. Include test results in operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide grounding equipment and accessories of types, sizes, ratings, and electrical characteristics indicated or as otherwise required to provide a complete system.

2.2 GROUNDING CONDUCTORS:

A. Unless noted otherwise, provide grounding conductors with stranding and insulation types to match phase conductors. Provide conductors with green insulation if possible; otherwise wrap with green tape. Size ground conductors as indicated on drawings. Do not size ground conductors smaller than that allowable by NEC.

2.3 GROUND RODS:

A. Provide copper clad, steel, 3/4" diameter by 10' long, ground rods (Weaver, Cadweld, or equivalent).

2.4 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND):

A. Provide a bare copper conductor encased along the bottom of concrete foundation or footing that is in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Size UFER ground conductor in accordance with the NEC. Extend conductor through a horizontal length of 30' minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils.

2.5 INSULATED GROUNDING BUSHINGS:

A. Provide plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners (OZ Gedney BLG or equivalent).

2.6 CONNECTION TO PIPES:

A. Provide heavy duty, cast bronze, ground clamp systems with silicon bronze bolts and nuts (OZ Gedney G Series - B or equivalent).

2.7 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES:

A. Provide exothermic welds. (Cadweld or equivalent)

2.8 BONDING JUMPERS:

A. Provide bonding jumpers with hot dip galvanized malleable or ductile iron clamps, hot dip galvanized steel U-bolts, and tinned copper braids (OZ Gedney BJ Series or equivalent).

2.9 GROUND BUS:

A. Provide 1/4" x 4", copper ground bus complete with insulators and brackets in lengths and at mounting heights as indicated on drawings. Furnish complete with drilled holes and lugs to accommodate grounding conductors.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install grounding systems in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CLEANING:

A. Thoroughly clean all metal contact surfaces prior to installation of clamp-on connectors.

3.3 SEPARATELY DERIVED SYSTEMS:

A. Ground each separately derived system in accordance with NEC Section 250.30 unless otherwise indicated on drawings.

3.4 SERVICE ENTRANCE GROUNDING:

A. Connect the following items using NEC sized copper grounding conductors (in NEC sized,

conduits if concealment is required) to lugs on the service ground bus:

1. Conductor from the UFER ground.
2. Conductor from two ground rods driven exterior to building at not less than 10' apart.
3. Conductor from main incoming cold water piping system.
4. Conductor from building structural steel.
5. Conductor from separately derived systems.
6. Conductor from insulated ground bushings on service entrance conduits.
7. Additional ground rods as required to achieve resistance value specified.
8. Additional items indicated on drawings.

3.5 EQUIPMENT BONDING AND GROUNDING:

A. Provide an NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Full length of all multi-outlet assemblies and other surface wireways.

3.6 ADDITIONAL GROUNDING INSTALLATION REQUIREMENTS:

A. Provide grounding bushings on all service conduit and conduits installed in concentric/eccentric knock-outs or reducing washer at panelboards, cabinets, and gutters.

B. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system. Connection to water piping system shall be made electrically continuous by connecting to the street side of the water main valve and/or installing additional bonding jumpers across the meter, valves or service unions that might be disconnected.

C. Provide bonding wire in all flexible conduits.

D. Isolated Ground Circuits: Circuits used for isolated ground outlets shall be run in separate raceways or shall have a separate green insulated ground conductor installed and tagged for identification at all outlet and junction boxes.

3.7 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section. Use independent testing agency for all testing.

END OF SECTION 16452

SECTION 16510 - INTERIOR AND EXTERIOR BUILDING LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to interior and exterior building lighting.

1.2 DESCRIPTION OF WORK:

A. Extent of interior and exterior building lighting work is indicated by drawings and schedules and is specified herein.

B. Type of lighting fixtures in this section include the following:

1. Fluorescent

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturer's Association standards and carry the CBM label.

B. SHOP DRAWINGS: Submit manufacturer's data on interior and exterior building lighting fixtures. Submit dimensioned drawings of all lighting fixtures. Identify light fixtures by type and submit in alphabetical order.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide light fixtures of types as indicated on drawings or as approved by addenda. Provide light fixtures complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, wiring, etc. Provide all light fixtures with safety latches where applicable.

B. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chains, or safety cables.

C. Provide all exterior fixtures with damp or wet location labels as required by application.

D. Provide all light fixtures and support accessories as required for a complete system.

E. Consult architectural drawings for louvers (if any) to be provided by Division 16.

2.2 FLUORESCENT LIGHT FIXTURES:

A. FLUORESCENT BALLASTS:

1. Electronic:
   a. Manufacturers: Provide electronic ballasts from manufacturers specified as an integral part of light fixtures on the light fixture schedule. Where "generic" electronic ballasts are specified, provide products of one of the following for each fixture type:
      1) Advance Transformer
      2) Magnetek
      3) Motorola
      4) Osram Sylvania
   b. Electronic Ballasts: Whether specified specifically or generically, provide electronic, fluorescent lamp ballasts for each type of fluorescent fixture capable of operating lamps indicated. Provide high power factor (97% or greater), Class P, sound-rated A, and internally thermally protected ballasts. Provide ballasts with input third harmonic content not exceeding 10% for 120V ballasts and less than 15% for 277V ballasts, average lamp current crest factor of 1.7, frequency of operation 20 KHz or greater, and non-PCB capacitors. Unless specifically noted otherwise, provide all interior light fixtures, with full light output electronic ballasts. Equip all exterior light fixtures with low temperature starting ballasts. Comply with all manufacturer's written recommendations for all lamp-ballast combinations.
   c. Programmed Start Electronic Ballasts: Electronic ballasts shall be programmed start for maximum lamp life on shorter start cycles. Filament voltage shall be applied prior to the application of open circuit voltage to allow adequate heating of the filaments and then open circuit voltage is applied to start the lamps. Ballasts shall provide for a minimum lamp starting temperature of 0 Degrees F.
   d. End-of-Life Circuitry: Ballasts for lamps of T5 and smaller including T5, T4, and T2 diameter shall contain end-of-life sensing circuitry to prevent lamp bulb, lamp base, or socket damage at lamp end-of-life.
2. Electromagnetic:
   a. Manufacturers: Subject to compliance with all requirements, provide products of one of the following for each fixture type:
      1) Advance Transformer - Mark III Series
      2) General Electric - Maxi-Miser II Series
      3) Universal - SLH-Watt Reducer Series
   b. Electromagnetic Ballasts: Provide electromagnetic, fluorescent lamp ballasts for each type of fluorescent fixture capable of operating lamps indicated. Provide high power factor (90% or greater), Class P, sound-rated A, and internally thermally protected ballasts. Unless specifically noted otherwise, provide all interior light fixtures, with full light output energy conserving ballasts. Equip all exterior light fixtures with low temperature starting ballasts. Comply with all manufacturer's written recommendations for all lamp-ballast combinations.
3. Ballast Disconnect:
   a. Fluorescent fixtures that can be serviced-in-place shall come equipped with a disconnecting means that allows the ballast to be disconnected simultaneously from all conductors during maintenance and repair. The means of disconnect shall be placed so that it is accessible to all individuals before service of the fixture or ballast is initiated.
   b. The line-side terminals of the ballast disconnect shall also be guarded.
   c. The ballast disconnect shall adhere to the requirements outlined in the code, NEC 2005 410.73(G).
4. Ballast Fusing: All ballasts shall be externally and individually fused.

B. FLUORESCENT LAMPS:

1. Manufacturers: Subject to compliance with all requirements, provide products of one of the following for each fixture type:
   a. General Electric
   b. Phillips
   c. Osram Sylvania
2. Lamps: Provide fluorescent lamps in types, wattages, and sizes as indicated on fixture schedule. Unless specifically noted otherwise, equip interior light fixtures with full light output, energy-conserving, fluorescent lamps.
3. T-8 Lamps: Where T-8 lamps are specified, provide General Electric "Trimline", Sylvania "Octron", or Phillips only with initial lumens outputs of 2950 minimum.
4. Provide TCLP-compliant lamps where available from the manufacturer.

C. DIFFUSERS: Where acrylic diffusers are specified, provide 100 percent virgin acrylic compound with minimum thickness of .125 inches.

2.3 HALOGEN LIGHT FIXTURES

A. Manufacturers: Subject to compliance with all requirements, provide products of one of the following for each fixture type:

1. General Electric
2. Phillips
3. Osram Sylvania

B. Halogen Lamps: Provide halogen lamps with increased LPW (IR technology) or improved optics in types, wattages, and sizes as indicated on the light fixture schedule.

2.4 HIGH INTENSITY DISCHARGE (HID) LIGHT FIXTURES:

A. HID BALLASTS:

1. Manufacturers: Subject to compliance with all requirements, provide products of one of the following for each fixture type:
   a. Advance Transformer
   b. General Electric
   c. Universal
2. Ballasts: Provide electromagnetic, constant wattage, HID lamp ballasts for each type of HID fixture capable of operating lamps indicated. Provide high power factor (90% of greater) ballasts. Provide HID ballasts for each HID fixture with features in accordance with all manufacturer's written recommendations. Equip all exterior light fixtures with low temperature (-10 degree F.) starting ballasts. Comply with all manufacturer's written recommendations for all lamp-ballast combinations.

B. HID LAMPS:

1. Manufacturers: Subject to compliance with all requirements, provide products of one of the following for each fixture type:
   a. General Electric
   b. Phillips
   c. Osram Sylvania
   d. Venture
2. Lamps: Provide HID lamps in types, wattages, and sizes as indicated on fixture schedule.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install interior and exterior light fixtures in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 SUPPORT REQUIREMENTS:

A. RECESSED LIGHT FIXTURES:

1. Lay-in Ceilings: Support all light fixtures in lay-in ceilings independent from the ceiling system. Support each recessed light fixture from the building structure with #12 gauge steel wire attached to each corner. Provide clips to securely fasten lay-in light fixtures to Tee-Bars. Provide suspension bars for downlight fixtures in lay-in ceilings.
2. Gypsum Board, Plaster, or Similar Ceilings: Support all light fixtures in hard ceilings independent from the ceiling system. Support each recessed light fixture from the building structure with #12 gauge steel wire attached to each corner. Provide backing supports and all mounting accessories as required.
3. Fire Ratings: Provide gypsum board protection for each light fixture recessed in fire-rated ceiling as required to maintain fire rating of penetrated ceiling.

3.3 PROTECTION AND CLEANING:

A. Protect installed and non-installed fixtures from damage during construction period.

B. Thoroughly clean all interior and exterior light fixtures. Do not mar or scar reflectors or diffusers. Repair all nicks and scratches to appearance of original finish. Remove protective plastic coverings on light fixtures at completion of project.

3.4 WIRING METHODS:

A. Route a minimum of 36" of 3/8" flexible conduit to each lay-in light fixture directly from an outlet box. Unless specified otherwise, flexible conduit shall not exceed 72" in length. Do not loop flexible conduit from fixture to fixture.

B. Grounding: Provide equipment grounding connections for each lighting fixture.

3.5 COORDINATION:

A. Refer to architectural reflected ceiling drawings for exact location and quantities of light fixtures, and ceiling types. Where conflicts occur between the architectural and electrical drawings, or where fixtures types do not coordinate with ceiling systems, notify architect/engineer prior to bid. After bid and award of contract, provide all light fixtures as required to meet the intent of the construction documents. Coordinate fixture layouts and installations with ceiling installer prior to submitting shop drawings and during construction. Fluorescent light fixtures shall be not less than 1/2" from combustible materials.

3.6 SPARE PARTS:

A. LAMPS: Provide 15% spare lamps, but in no case less than one, of each type, wattage, and size used for the project.

B. ACRYLIC DIFFUSERS: Provide a spare acrylic diffusers and/or glass for each light fixture type and one for each additional unit for each ten fixtures. The quantity of any single type need not exceed 10.

C. ELECTRONIC BALLASTS: Provide 2% spare electronic ballasts.

3.7 WARRANTY:

A. LAMPS: Warranty fluorescent lamps for a period of two months from substantial completion.

B. ELECTRONIC BALLASTS: Warranty electronic ballasts for parts and labor for complete replacement for a period of five years. Warranty shall include an allowance for nominal replacement labor and replacement of defective product.

END OF SECTION 16510

SECTION 16532 - FLUORESCENT EMERGENCY BALLASTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 sections making reference to fluorescent emergency ballasts.

1.2 DESCRIPTION OF WORK:

A. Extent of fluorescent emergency ballasts work is indicated by drawings and schedules and is specified herein.

B. Type of fluorescent emergency ballasts include the following:

1. Compact Fluorescent Emergency Ballasts

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

B. SHOP DRAWINGS: Submit manufacturer's data on fluorescent emergency ballasts.

PART 2 – PRODUCTS

2.1 COMPACT FLUORESCENT EMERGENCY BALLASTS:

A. Provide compact fluorescent emergency ballasts in accordance with the following:

1. Shall operate one quad or triple-tube lamp at approximately 350 -750 lumens initially depending on wattage of lamp used for a minimum of 90 minutes.
2. Battery shall be long life nickel cadmium type. Charger shall be capable of full recharge in 24 hours.
3. Unit shall be complete with charging solid-state indicator light, double-pole test switch, and installation hardware.
4. Unit shall be rated for dual voltage (120/277 VAC).
5. Subject to all requirements, provide fluorescent emergency ballasts from one of the following manufacturers:
   a. Bodine
   b. Chloride
   c. Lithonia
   d. Iota
   e. Emergi-Lite

PART 3 - EXECUTION

3.1 GENERAL:

A. Install fluorescent battery ballasts in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 METHODS:

A. Installation:

1. Compact Fluorescent Emergency Ballasts: Install compact fluorescent emergency light packs in ceiling adjacent to downlight. Install test/monitor plate close to the fixture in the ceiling.

B. Wire so unit can be tested with lights on.

C. Unless noted otherwise on drawings, wire so lamps in normal mode are switched off with other lighting in area. Connect emergency lighting unit to unswitched conductor of normal lighting circuit.

3.3 WARRANTY:

A. Compact Fluorescent Emergency Ballasts: Warranty compact fluorescent emergency ballasts lamps for a period of two (2) years (Not pre-rata).

END OF SECTION 16532

SECTION 16551 - EXTERIOR AREA LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to exterior area lighting.

1.2 DESCRIPTION OF WORK:

A. Extent of exterior area lighting work is indicated by drawings and schedules and is specified herein.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions and other sections as applicable.

B. SHOP DRAWINGS: Submit manufacturer's data on exterior area lighting items including but not necessarily limited to poles, brackets, light fixtures, fuse, fuseblocks, etc. Submit dimensioned drawings of all pole and lighting fixtures. Include information with interior and exterior building lighting fixtures.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide exterior lighting fixtures of types as indicated on drawings or as approved by addenda.

2.2 LIGHT FIXTURES:

A. Refer to Section 16510 - Interior and Exterior Building Lighting for requirements for exterior light fixtures, lamps, ballasts, etc.

2.3 CONCRETE BASES:

A. Provide 3000 psi class concrete, forms, steel reinforcement, tie wires, etc. as required. See drawings for details.

2.4 GROUND RODS:

A. See Section 16452 - Grounding for ground rod requirements.

2.5 FUSEHOLDER, FUSES, AND BREAK-A-WAY RECEPTACLES:

A. Provide fuseholders with break-a-way receptacles equivalent to Bussmann Tron Waterproof Fuseholders and Break-A-Way Receptacles in the base for all phase conductors and materials.

Neutral fuse holder will use a shorting fuse insert. Provide Bussmann KTK-R fuses in ratings to suit respective applications and sized in accordance with all manufacturer's recommendations.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install exterior area lighting in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 INSTALLATION METHODS:

A. Locate fuseholder at handhole. Provide fuse blanks in all neutral conductors.

B. Grounding: Provide one ground rod for each light pole. Connect ground rod to pole by means of an NEC-sized grounding conductor and all additional grounding as required.

3.3 CONCRETE BASES:

A. Provide concrete bases for landscape lighting in accordance with details on drawings. Grout and hand-rub all concrete to a uniform smooth finish.

3.4 SPARE PARTS:

A. FUSES: Provide three spare fuses for each type and size used.

3.5 WIRING METHODS:

A. No common neutral multi-wire circuits will be used to feed area lighting. Provide dedicated neutral wire for each circuit indicated.

END OF SECTION 16551

SECTION 16740 - TELEPHONE AND DATA SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 16 General Provisions section, and is part of each Division 16 section making reference to telephone and data systems.

1.2 DESCRIPTION OF WORK:

A. Extent of telephone and data systems is indicated by drawings and schedules and is specified herein. Telephone and data systems includes the following:

1. Telephone/data terminal backboards
2. Outlet Boxes and Raceways
3. Grounding

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 16001 - Electrical General Provisions as applicable.

1.4 SHOP DRAWINGS: Not required.

PART 2 – PRODUCTS

2.1 TELEPHONE/DATA TERMINAL BACKBOARDS:

A. Provide 2'W x 4'H x 3/4"D, fire-treated or hypalon-coated plywood terminal backboard. Finish with insulating varnish.

2.2 TELEPHONE/DATA TERMINAL CABINETS:

A. Provide terminal cabinets of code gauge steel, flush or surface, as shown, with concealed trim clamps, concealed hinges and flush locks. Paint in color as selected by architect.

2.3 OUTLET BOXES AND RACEWAYS:

A. Provide outlet boxes and raceways in accordance with the following sections.

1. Section 16110 - Conduit Raceways.
2. Section 16135 - Electrical Boxes & Fittings
3. Section 16072 – Electrical Support and Seismic Restraints

2.4 GROUNDING:

A. Provide grounding conductors and accessories in accordance with the following sections:

1. Section 16120 - Conductors and Cables
2. Section 16452 - Grounding.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install telephone/data systems in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 RACEWAYS:

A. Unless otherwise noted, extend 1" conduit from each telephone/data outlet to telephone terminal backboard, cabinet, or cable tray.

B. Minimum trade size is 3/4". Install a 200 lb. polypropylene pull cord in each empty conduit run.

C. Where raceway systems only are specified, provide blank coverplates for all unused telephone and data outlets.

3.3 GROUNDING:

A. Extend one #6 bare copper ground conductor from each telephone terminal board and/or cabinet to the service entrance ground bus. Coil 6' of conductor at each terminal backboard and/or cabinet.

END OF SECTION 16740