STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT
Project Budgets Over $100,000

July 23, 2008

Otter Creek Restroom Phase 2

Division of Parks and Recreation

Antimony, Utah

DFCM Project Number 08026510

Campbell & Associates
46 North 200 East
St. George, Utah 84770

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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 : Attached and dated 5-15-08
Drawings: Attached and dated 5-15-08

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:

DNR – PARKS AND RECREATION
OTTER CREEK STATE PARKS RESTROOM PHASE 2
DFCM PROJECT NO:08026510

Bids will be in accordance with the Contract Documents that will be available on **Wednesday, July 23, 2008**, 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 Jeff Reddoor, DFCM, at 801-971-9830. No others are to be contacted regarding this bidding process. The construction estimate for this project is $240,000.00

A **mandatory** pre-bid meeting will be held at **1:00 PM** on **Thursday, July 31, 2008** at Otter creek State Park, Entrance Station, Antimony, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of **2:30 PM** on **Tuesday, August 12, 2008** 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

Construct one new 900 SF (approximate) Restroom/shower facilities at Otter Creek State Park,.Slab on grade, CMU walls, trussed roof, and standing seam roofing. Tie into adjacent existing utilities. Concrete apron and minor asphalt work around building perimeter.

PROJECT SCHEDULE

PROJECT NAME: OTTER CREEK RESTROOMS PHASE 2
DIVISION OF PARKS & RECREATION – ANTIMONY, UTAH
DFCM PROJECT NO. 08026510

Event	Day	Date	Time	Place
Bidding Documents Available	Wednesday	July 23, 2008	2:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-bid Site Meeting	Thursday	July31, 2008	1:00 PM	Otter Creek State Park Antimony, Utah
Last Day to Submit Questions	Wednesday	August 6, 2008	3:00 PM	Jeff Reddoor – DFCM E-mail jreddoor@utah.gov Fax 801-538-3267
Addendum Deadline (exception for bid delays)	Thursday	August 7, 2008	4:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Tuesday	August 12, 2008	2:30 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Wednesday	August 13,2008	2:30 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Friday	January 30, 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 **Otter Creek Restroom Phase 2 – Division of Parks & Recreation – Antimony, Utah – DFCM Project No. 08026510** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

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

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

I/We guarantee that the Work will be Substantially Complete by January 30, 2009, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$500.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

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

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

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

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in 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:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

_____
NOTARY PUBLIC

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

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

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, 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 July 15, 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
July 15, 2008
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

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

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

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

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

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

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

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

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

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

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

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

PAYMENT BOND

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

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

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

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

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

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

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

My commission expires: _____

Resides at: _____

_____
NOTARY PUBLIC

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

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

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

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

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

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

_____

_____

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

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:

PROJECT MANUAL

OTTER CREEK RESTROOM BUILDINGS

OTTER CREEK STATE PARK & STATE HWY U-22
PAIUTE COUNTY, UTAH 84712

DFCM PROJECT #07172510

SET #

DATE: 05/15/2008
JOB: 08006
BY: K. CAMPBELL
REVISIONS:

STATE OF UTAH
KIM O. CAMPBELL
0112002016
REGISTERED ARCHITECT

CAMPBELL & ASSOCIATES L.L.C.
ARCHITECTS
46 NORTH 200 EAST ST. GEORGE, UTAH 84770
PHONE (435)628-5969 FAX (435)628-5975 E-MAIL camarch@infowest.com

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CAMPBELL & ASSOCIATES
ARCHITECTS L.L.C
ST. GEORGE P.C.

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03 4000 PRECAST CONCRETE

03 4800 PRECAST CONCRETE SPECIALTIES

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SECTION 03 1113

STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Design, construction, and safety of formwork.
   2. Furnish and install required formwork ready for placing of concrete.
   3. Strip and dispose of formwork.

B. Related Sections
   1. Section 03 3111: Tolerances for placing normal weight structural concrete.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM D 1751-99, 'Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).'

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Forms: Wood, metal, or plastic as arranged by Contractor. Forming material shall be compatible with specified form release agents and with finish requirements for concrete to be left exposed or to receive decorative finish.

B. Form Release Agents:
   1. Unexposed Surfaces Only: Contractor's option.
   2. Vertical, Exposed Surfaces or Unexposed Surfaces:
      a. Chemically acting type.
      b. Type Two Acceptable Products.
         1) Crete-Lease 727 or 20-VOC by Cresset Chemical Co, Weston, OH www.cresset.com.
         2) Clean Strip (J-1 or J-3 VOC) by Dayton / Richmond Concrete Accessories, Miamisburg, OH www.daytonrichmond.com.
         3) E-Z Strip or DEBOND Form Coating by L & M Construction Chemicals, Omaha, NE www.lmcc.com.
         4) Q-2 by Unitex, Kansas City, MO www.unitex-chemicals.com.
         5) U S Spec SlicKote by U S Mix Products Co www.usspec.com.
         6) Duogard or Duogard II by W R Meadows, Elgin, IL www.wrmeadows.com.
         7) Equal as approved by Architect before use. See Section 01 6200.

C. Expansion / Contraction Joints:
   1. 1/2 inch thick.
   2. Manufactured commercial fiber type:
      a. Meet requirements of ASTM D 1751.
      b. Type Two Acceptable Products:
         1) Conflex by Knight-Celotex, Northfield, IL www.aknightcompany.com.

2) Sealtight by W R Meadows Inc, Hampshire, IL www.wrmeadows.com.
3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Forms:
1. Assemble forms so forms are sufficiently tight to prevent leakage.
2. Properly brace and tie forms.
3. Provide temporary cleanouts at base of tall forms to facilitate cleaning and inspection.
4. Make proper form adjustments before, during, and after concreting.
5. Use new forms, or used forms that have been cleaned of loose concrete and other debris from previous concreting and repaired to proper condition. Provide smooth liner on forms used for concrete to be exposed if necessary to attain specified finish quality.
6. Use metal cold joint forms when unable to place concrete for footings, foundations, and slabs in continuous pours.
7. Provide beveled 2 inch by 4 inch keys where shown on Drawings for tall or heavily loaded walls.

B. Accessories:
1. Provide for installation of inserts, templates, fastening devices, and other accessories to be set in concrete before placing.
2. Position anchor bolts for hold-down anchors and columns and securely tie in place before placing concrete.

C. Form Release Agents:
1. Film thickness shall be no thicker than as recommended by Manufacturer to attain specified finish. Finish on vertical, exposed concrete shall be of quality equal to CCS-1 or CCS-2 surface as defined by Cresset Chemical.
2. Allow no release agent on reinforcing steel or footings.

D. Expansion Joints: Install at joints between floor slab and foundation wall where shown on Drawings.

E. Form Removal: Removal of forms can usually be accomplished in 12 to 24 hours. If temperature is below 50 deg F or if concrete (stairs, beams, etc) depends on forms for structural support, leave forms intact for sufficient period for concrete to reach adequate strength.

END OF SECTION

SECTION 03 1511

ANCHORS AND INSERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Concrete anchors and inserts not specified elsewhere.

B. Related Sections:
   1. Section 03 3111: Installation.
   2. Section 05 0523: Quality of anchor bolts.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Adhesive Anchors:
   1. Type Two Acceptable Products:
      a. Ultrabond by Adhesives Technology Corp.
      b. HIT HY-150 System or HIT HY-MAX System by Hilti.
      c. Power-Fast System by Powers Fastening.
      d. EPCON System by Ramset / Redhead.
      e. SET Adhesive by Simpson.
      f. Pro-Poxy by Unitex.
      g. Equal as approved by Architect before installation. See Section 01 6200.

B. Drilled-In Anchors:
   1. Type Two Acceptable Products:
      a. Wedge Anchors by Adhesives Technology Corp.
      b. Kwik Bolt 3 by Hilti.
      c. SUP-R-STUDS by MKT Fastening.
      d. Power-Stud by Powers Fastening.
      e. TruBolt Carbon Wedge Anchors by Ramset / Redhead.
      f. Wedge-All Wedge Anchors by Simpson.
      g. Equal as approved by Architect before installation. See Section 01 6200.

2.2 MANUFACTURERS

A. Contact Information:
   1. Adhesives Technology Corp, Pampano Beach, FL www.usanchor.net.
   2. Hilti Fastening Systems, Tulsa, OK www.hilti.com.
   3. ITW Ramset / Redhead, Wood Dale, IL www.ramset-redhead.com.
   4. MKT Fastening Corp, Lonoke, AR www.mktfastening.com.
   5. Powers Fastenings Inc, New Rochelle, NY www.powers.com.
   6. Simpson Strong-Tie, Dublin,CA www.strongtie.com.
   7. Unitex, Kansas City, MO www.unitex-chemicals.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Epoxy Anchors:

B. Drilled-In Anchors:

END OF SECTION

SECTION 03 2100

REINFORCING STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install concrete reinforcing steel as described in Contract Documents.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 318-83.

B. American Society For Testing And Materials:
   1. ASTM A 615-00, 'Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.'

1.3 QUALITY ASSURANCE

A. Certification: Mill tests for reinforcing in accordance with ASTM A 615.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing steel shall be free of heavy rust scales and flakes, or other coating at time of delivery and placing. Properly protect rebar on site after delivery.

B. Deliver bars separated by size and tagged with manufacturer's heat or test identification number.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Reinforcing Steel:
   1. Reinforcing bars shall have grade identification marks and conform to ASTM A 615.
      a. Grade 60 minimum, except dowels that are to be field bent, Grade 40 minimum.
      b. Bars shall be deformed type.
      c. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

B. Bar Supports:
   1. Type Two Acceptable Products:
      a. Concrete 'dobies' or blocks wired to reinforcing.
      b. Manufactured chairs with 4 sq in bearing surface with sub-grade, or other feature to prevent chair from being pushed into sub-grade.
      c. Equals as approved by Architect before installation. See Section 01 6200.

2.2 FABRICATION

A. Fabricate reinforcing steel according to 'ACI Detailing Manual,' 1988 edition, and details on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bend bars cold.

B. Accurately place and support with chairs, bar supports, spacers, or hangers as recommended by 'ACI Detailing Manual,' 1988 edition, except slab on grade work. Support bars in slabs on grade and footings with specified bar supports around perimeter and at 4-1/2 feet 1 350 mm on center each way maximum to maintain specified concrete cover. Install bar supports at bar intersections.

C. Dowel vertical reinforcement for formed concrete columns or walls out of footing or structure below with rebar of same size and spacing required above.

D. Securely anchor and tie reinforcing bars and dowels before placing concrete. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Avoid splices of reinforcing bars at points of maximum stress. Lap bars 40 bar diameters minimum unless dimensioned otherwise on Drawings. Run steel reinforcing bars continuous through cold joints.

END OF SECTION

SECTION 03 2200

WELDED WIRE FABRIC REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install welded wire fabric as described in Contract Documents.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 185-02, 'Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing:
   1. Flat sheets of welded steel wire fabric for concrete reinforcement meeting requirements of ASTM A 185.
   2. Style: 6 x 6 - W1.4 x W1.4.

B. Reinforcing Supports:
   1. Type Two Acceptable Product:
      a. Concrete 'dobies' or blocks wired to reinforcing.
      b. Manufactured chairs with 4 sq in bearing surface with sub-grade, or other feature to prevent chair from being pushed into sub-grade.
      c. Equals as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tie mesh together 24 inches 600 mm on center minimum with 6 inch 150 mm overlap.

B. Support wire mesh sheets at 24 inches 600 mm on center along edges and 24 inches 600 mm on center minimum each way in field with reinforcing supports to maintain mesh in center of slab.

END OF SECTION

B L A N K P A G E

SECTION 03 3053

MISCELLANEOUS EXTERIOR CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Compact sub-base for miscellaneous cast-in-place concrete as described in Contract Documents.
   2. Furnish and install granular base for miscellaneous cast-in-place concrete and equipment pads as described in Contract Documents.
   3. Furnish and install sealants and curing compounds as described in Contract Documents.

B. Related Sections:
   1. Section 07 9213: Quality of Sealants.
   2. Section 31 2323: Compaction procedures and tolerances.
   3. Section 32 8423: Sleeves for underground irrigation system.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM D 1751-99, 'Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Formwork: Meet requirements specified in Section 03 1113.

B. Granular Base:
   1. Road Base type gravel or crushed rock, graded by weight as follows:

Sieve	Percent Passing	Sieve	Percent Passing
One Inch	100	25 mm	100
3/4 Inch	85 - 100	19 mm	85 - 100
No. 4	45 - 60	5 mm	45 - 60
No. 10	30 - 50	1.2 mm	30 - 50
No. 200	5 - 10 (non-plastic)	0.063 mm	5 - 10 (non-plastic)

C. Expansion Joints:
   1. 1/2 inch 13 mm thick.
   2. Manufactured commercial fiber type:
      a. Meet requirements of ASTM D 1751.
      b. Type Two Acceptable Products:
         1) Conflex by Knight-Celotex, Northfield, IL www.aknightcompany.com.
         2) Sealtight by W R Meadows Inc, Hampshire, IL www.wrmeadows.com.
         3) Equal as approved by Architect before installation. See Section 01 6200.

D. Concrete: Meet requirements specified in Section 03 3111 for exterior concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sub-Base: Compact sub-base as specified in Section 32 2213.

3.2 INSTALLATION

A. Granular Base: Place 4 inches 100 mm minimum of granular base, level, and compact as specified in Section 32 2213.

B. Joints:
   1. Expansion And Contraction Joints:
      a. Install so top of expansion joint material is 1/4 inch 6 mm below finished surface of concrete.

   2. Scored Control Joints:
      a. Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than one inch 25 mm.

C. Finish:
   1. Sidewalks And Miscellaneous:
      a. Broom finish.
      b. Round edges including edges formed by expansion joints.
   2. Remove edger marks.

D. Special Requirements:
   1. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree into landscaped areas.
   2. Sidewalks And Landings:
      a. Slope sidewalks with cross slope of 1/8 to 1/4 inch per ft 3 to 6 mm per 300 mm in direction of intended drainage.
      b. Slope sidewalks away from building.
      c. Do not dust with cement.
   3. Membrane Curing Compound: Apply specified product to curbs, gutters, sidewalks, flat drainage structures, stairs, landings, and pads as specified in Section 03 3923.

3.3 FIELD QUALITY CONTROL

A. Inspection: To allow Architect's verification of grades and elevations, notify Architect three days minimum before placing concrete for specified concrete site elements.

END OF SECTION

SECTION 03 3111

NORMAL WEIGHT STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install Project concrete work as described in Contract Documents.
   2. Quality of concrete used on Project but furnished under other Sections.

B. Products Installed But Not Supplied Under This Section:
   1. Inserts, bolts, boxes, templates, and fastening devices for other work, including those for bases only for Mechanical and Electrical.
   2. Concrete accessories.

C. Related Sections:
   1. Divisions 22, 23, And 26: Mechanical and electrical devices including boxes, conduits, pipes, hangers, inserts, and other work to be embedded in concrete work before placing.
   2. Section 31 2324: Granular base course under slabs.
   3. Furnishing of items to be embedded in concrete specified in Section involved.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 33-03, 'Standard Specification for Concrete Aggregates.'
   2. ASTM C 94-03, 'Standard Specification for Ready-Mixed Concrete.'
   3. ASTM C 150-04, 'Standard Specification for Portland Cement.'
   4. ASTM C 260-01, 'Standard Specification for Air-Entraining Admixtures for Concrete.'
   5. ASTM C 494-04, 'Standard Specification for Chemical Admixtures for Concrete.'
   6. ASTM C 618-03, 'Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.'
   7. ASTM E 1155-96 (2001), 'Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.'

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Conform to requirements of ASTM C 94 unless specified otherwise.
   2. For testing purposes, following concrete strengths are required:
      a. At 7 days: 60 percent minimum of 28 day strengths.

1.4 SUBMITTALS

A. Quality Assurance / Control:
   1. Concrete mix design.
   2. Delivery Tickets: Require mix plant to furnish delivery ticket for each batch of concrete. Keep delivery tickets at job-site for use of Owner or his representatives. Tickets shall show following:
      a. Name of ready-mix batch plant.
      b. Serial number of ticket.

c. Date and truck number.
d. Name of Contractor.
e. Name and location of Project.
f. Specific class or designation of concrete conforming to that used in Contract Documents.
g. Amount of concrete.
h. Time loaded.
i. Type, name, manufacturer, and amount of admixtures used.
j. Amount and type of cement.
k. Total water content.
l. Sizes and weights of sand and aggregate.

1.5 QUALITY ASSURANCE

A. Pre-Installation Conference:
1. Schedule pre-installation conference after placing of footings, installation of foundation forms and reinforcing steel, and installation of anchors, dowels, inserts, and block outs in foundation walls and slabs, but before placing of concrete.
2. In addition to agenda items specified in Section 01 3100, review following:
a. Approved mix design and use of admixtures.
b. Installation scheduling, coordination, and placement of items installed in and under floor slab.
c. Placement, finishing, and curing of concrete including cold and hot weather requirements.
d. Concrete slab tolerances and corrective measures if tolerances not met.

1.6 PROJECT CONDITIONS

A. Project Environmental Requirements:
1. Cold Weather Concreting Procedures:
a. General Requirements:
1) Materials and equipment required for heating and protection of concrete shall be approved and available at Project site before beginning cold weather concreting.
2) Forms, reinforcement, metallic embedments, and fillers shall be free from snow, ice, and frost. Surfaces that will be in contact with newly placed concrete, including sub-grade materials, shall be 35 deg F 2 deg C minimum at time of concrete placement.
3) Thaw sub-grade 6 inches 150 mm deep minimum before beginning concrete placement. If necessary, re-compact thawed material.
4) Use no frozen materials or materials containing ice.
b. Requirements When Average 24 Hour Temperature, midnight to midnight, Is Below 40 deg F 4 deg C:
1) Temperature of concrete as placed and maintained shall be 55 deg F 13 deg C minimum and 75 deg F 27 deg C maximum.
2) Heat concrete for 72 hours minimum after placing if regular cement is used; for 48 hours if high early strength cement is used; or longer if determined necessary by Architect. During this period, maintain concrete surface temperature between 55 and 75 deg F 13 and 27 deg C.
3) Vent flue gases from combustion heating units to outside of enclosure to prevent carbonation of the concrete surface.
4) Prevent concrete from drying during heating period. Maintain housing, insulation, covering, and other protection 24 hours after heat is discontinued.
5) After heating period, if temperature falls below 32 deg F 0 deg C, protect concrete from freezing until strength of 2000 psi 14 MPa minimum is achieved. Protect flatwork exposed to melting snow or rain during day and freezing during night from freezing until strength of 3500 psi 24 Mpa minimum is achieved.
c. Requirements When Average 24 Hour Temperature, midnight to midnight, Is Above 40 deg F 4 deg C, but when temperature falls below 32 deg F 0 deg C:
1) Protect concrete from freezing for 72 hours after placing, or until a strength of 2000 psi 14 Mpa is achieved, whichever is longer. Protect flatwork exposed to melting snow or

rain during day and freezing during night from freezing until strength of 3500 psi 24 Mpa minimum is achieved.

d. Protect soil supporting concrete footings from freezing under any circumstances.

2. Hot Weather Concreting Procedures:
   a. Maximum concrete temperature allowed is 90 deg F 32 deg C in hot weather.
   b. Cool aggregate and subgrades by sprinkling.
   c. Avoid cement over 140 deg F 60 deg C.
   d. Use cold mixing water or ice.
   e. Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: Meet requirements of ASTM C 150, Type 5.

B. Aggregates:
1. Coarse:
   a. Meet requirements of ASTM C 33 or nonconforming aggregate that by test or actual service produces concrete of required strength and conforms to local governing codes.
   b. Aggregate shall be uniformly graded by weight as follows:
      1) Flat Work, Size No. 67.

Sieve	Percent Passing	Sieve	Percent Passing
One Inch	100	25 mm	100
3/4 Inch	90 - 100	19 mm	90 - 100
3/8 Inch	20 - 55	9 mm	20 - 55
No. 4	0 - 10	4.75 mm	0 - 10
No. 8	0 - 5	2.36 mm	0 - 5

      2) All Other, Size No. 57.

Sieve	Percent Passing	Sieve	Percent Passing
1-1/2 Inch	100	38 mm	100
One Inch	95 - 100	25 mm	95 - 100
1/2 Inch	25 - 60	12 nm	25 - 60
No. 4	0 - 10	4.75 mm	0 - 10
No. 8	0 - 5	2.36 mm	0 - 5

2. Fine:
   a. Meet requirements of ASTM C 33.
   b. Aggregate shall be uniformly graded by weight as follows:

Sieve	Percent Passing	Sieve	Percent Passing
3/8 Inch	100	9 mm	100
No. 4	95 - 100	4.75 mm	95 - 100
No. 8	80 - 100	2.36 mm	80 - 100
No. 16	50 - 85	1.18 mm	50 - 85
No. 30	25 - 60	0.60 mm	25 - 60
No. 50	10 - 30	0.30 mm	10 - 30
No. 100	2 - 10	0.15 mm	2 - 10

C. Water: Clear, apparently clean, and potable.

D. Admixtures And Miscellaneous:
1. Mineral:
   a. Fly Ash Pozzolan: Meet requirements of ASTM C 618, Class F or C and with loss on ignition (LOI) of 3 percent maximum.
2. Chemical:

a. No admixture shall contain calcium chloride nor shall calcium chloride be used as an admixture. All chemical admixtures used shall be from same manufacturer and compatible with each other.
b. Air Entraining Admixture:
    1) Meet requirements of ASTM C 260.
    2) Type Two Acceptable Products:
        a) Air Mix 200 or AEA-92 by Euclid.
        b) Air plus or Super Air Plus by Fritz-Pak.
        c) MB-VR, MB-AE or Micro Air by Master Builders.
        d) Sika Air by Sika.
        e) Daravair or Darex II AEA by W R Grace.
        f) Equal as approved by Architect before use. See Section 01 6200.
c. Water Reducing Admixture:
    1) Meet requirements of C 494, Type A and containing not more than 0.05 percent chloride ions.
    2) Type Two Acceptable Products:
        a) Eucon WR 75 or Eucon 91 by Euclid.
        b) FR-2 or FR-3 by Fritz-Pak.
        c) Pozzolith Series by Master Builders.
        d) Plastocrete 160 by Sika.
        e) Daracem 50/55, WRDA-64, or WRDA-82 by W R Grace.
        f) Equal as approved by Architect before use. See Section 01 6200.
d. Water Reducing, Retarding Admixture:
    1) Meet requirements of ASTM C 494, Type D and contain not more than 0.05 percent chloride ions.
    2) Type Two Acceptable Products:
        a) Eucon Retarder 75 by Euclid.
        b) FR-1 or Modified FR-1 by Fritz-Pak.
        c) Pozzolith Series by Master Builders.
        d) Plastiment by Sika.
        e) Daratard-17 or Daratard-40 by W R Grace.
        f) Equal as approved by Architect before use. See Section 01 6200.
e. High Range Water Reducing Admixture (Superplasticizer):
    1) Meet requirements of ASTM C 494, Type F or G and containing not more than 0.05 percent chloride ions.
    2) Type Two Acceptable Products:
        a) Eucon 37 or Eucon 537 by Euclid.
        b) Supercizer 1 through 7 by Fritz-Pak.
        c) Rheobuild 1000 or Glenium Series by Master Builders.
        d) Sikament 300 by Sika.
        e) Darachem-100 or WRDA-19 by W R Grace.
        f) Equal as approved by Architect before use. See Section 01 6200.
f. Non-Chloride, Non-Corrosive Accelerating Admixture:
    1) Meet requirements of ASTM C 494, Type C or E and not contain more chloride ions than are present in municipal drinking water.
    2) Type Two Acceptable Products:
        a) Accelguard 80 by Euclid.
        b) Pozzolith NC 534 or 122HE or Pozzutec 20+
        c) Daraset or Polarset by W R Grace.
        d) Equal as approved by Architect before use. See Section 01 6200.

3. Evaporation Retardant:
    a. Type Two Acceptable Products:
        1) Sure Film J-74 by Dayton Superior.
        2) Euco-Bar By Euclid Chemical Co.
        3) E-Con by L & M Construction Chemicals.
        4) Confilm by Master Builders.
        5) Pro Film by Unitex.
        6) U S Spec Monofilm ER by U S Mix Products.
        7) Equal as approved by Architect before use. See Section 01 6200.
4. Bonding Agents:

a. Type Two Acceptable Products:
   1) Day Chem Ad Bond (J-40) by Dayton Superior.
   2) Flex-Con by Euclid Chemical Co.
   3) Larsen Weldcrete by Larsen Products Corp.
   4) Everbond by L & M Construction Chemicals.
   5) Acryl Set by Master Builders.
   6) Sonocrete by Sonneborn.
   7) Tamms Bond by TAMMS Industries.
   8) U S Spec Multicoat by U S Mix Products.
   9) Acrylic Additive by W R Bonsal.
   10) Intralok by W R Meadows.
   11) Equal as approved by Architect before use. See Section 01 6200.

2.2 MANUFACTURERS

A. Contact Information:
   1. Bonsal American, Charlotte, NC www.bonsal.com.
   2. Dayton Superior Concrete Chemicals, Miamisburg, IL www.daytonsuperiorchemical.com.
   3. Euclid Chemical Company, Cleveland, OH www.euclidchemical.com.
   4. Fritz-Pak Concrete Admixtures, Dallas, TX www.fritzpak.com.
   5. Grace Construction Products, Cambridge, MA www.graceconstruction.com.
   6. L & M Construction Chemicals, Omaha, NE www.lmcc.com.
   7. Larsen Weldcrete by Larsen Products Corp, Rockville, MD www.larsenproducts.com.
   8. Master Builders / deGussa Admixtures, Cleveland, OH www.masterbuilders.com.
   9. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com.
   10. Sonneborn / deGussa Building Systems, Shakopee, MN www.chemrex.com.
   11. TAMMS Industries, Mentor, OH www.tamms.com.
   12. Unitex, Kansas City, MO www.unitex-chemicals.com.
   13. U S Mix Products Co, Denver, CO www.usspec.com.
   14. W R Meadows, Hampshire, IL www.wrmeadows.com.

2.3 MIXES

A. Submit mix designs to meet following requirements:
   1. Proportions:
      a. Mix Type 1: 3000 psf
         1) Minimum weight cement per cu yd concrete: 517 lbs 235 kg.
         2) Water / Cement Ratio: 0.50 maximum by weight.
      b. Mix Type 2: 4000 psf
         1) Minimum weight cement per cu yd concrete: 564 lbs 256 kg.
         2) Water / Cement Ratio: 0.45 maximum by weight.
      c. Air Entrainment:
         1) Exterior Concrete: 6 percent, plus or minus 1-1/2 percent.
      d. Do not add water any time during mixing cycle above amount required to meet specified water / cement ratio. No reduction in the amount of cementitious material is allowed.
   2. Admixtures:
      a. Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without Architect's written approval.
      b. Mineral: An amount of specified fly ash not to exceed 20 percent of weight of cement may be substituted for cement. If substituted, consider fly ash with cement in determining amount of water necessary to provide specified water / cement ratio.
      c. Chemical:
         1) 4 inch 100 mm slump maximum before addition of high range water reducer.
         2) 8 inch 200 mm slump maximum with use of high range water reducer.
         3) Specified accelerator or retarder may be used if necessary to meet environmental conditions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by Divisions 22, 23, and 26 shall be installed and inspected before placing concrete.

B. Install inserts, bolts, boxes, templates, pipes, conduits, and other accessories furnished under other Sections to be installed as part of work of this Section. Tie anchor bolts for hold-down anchors and columns securely to reinforcing steel.

C. Remove water and debris from space to be placed.

3.2 INSTALLATION

A. Site Tolerances:
1. Tolerances shall conform to requirements of ACI 117, except where specified differently.
   a. Table Four: Maximum Variation Tolerances.

Thickness, standard	plus 3/8 inch, minus 1/4 inch	plus 9 mm, 3 mm
Thickness, footings	minus 0 inch	minus 0 mm
Plan, 0 - 20 feet	1/2 inch	12 mm
Plan, 40 feet or greater	3/4 inch	19 mm
Plan, footings	plus 1/2 inch	plus 12 mm
Eccentricity, footings	2 inch max standard, 1/2 inch at masonry	50 mm max standard, 12 mm at masonry
Openings, size	minus 1/4 inch, plus One inch	minus 6 mm, plus 25 mm
Openings, location	plus / minus 1/2 inch at center	plus / minus 12 mm at center
Plumb	1/2 inch max	6 mm max

B. Placing:
1. Place as soon after mixing as possible. Deposit as nearly as possible in final position. Placing of concrete shall be continuous until a panel or section is complete.
2. In order to avoid overloading of forms and ties, observe following rate of filling for various air temperatures:
   a. Table Five: Placing Rate.

Temperature	Rate of Fill per Hour	Temperature	Rate of Fill per Hour
40 deg F	2 feet	4 deg C	600 mm
50 deg F	3 feet	10 deg C	900 mm
60 deg F	4 feet	16 deg C	1 200 mm
70 deg F	5 feet	21 deg C	1 500 mm

3. Compact concrete in forms by vibrating and other means where required. Thoroughly work in concrete around reinforcing bars.
4. Do not embed aluminum in concrete.
5. Do not use contaminated, deteriorated, or re-tempered concrete.
6. Avoid accumulation of hardened concrete.
7. Joints:
   a. Where possible, locate joints under partitions or where joints will cause least disruption to floor coverings.
   b. Construction Joints: Locate where shown on Drawings to least impair strength of completed structure. Construction joints in foundation walls shall not occur within 6 feet 1 800 mm of corner and be keyed.

C. Bonding Fresh And Hardened Concrete:
1. Re-tighten forms.
2. Roughen surfaces.
3. Clean off foreign matter and laitance.

4. Wet but do not saturate.
5. Slush with neat cement grout or apply bonding agent.
6. Proceed with placing new concrete.

D. Special Requirements:
1. Footings:
   a. Bear 36 inches 300 mm minimum into undisturbed earth. Exterior wall footing shall bear 36" minimum below finish grades.
   b. Level top of finish footing and leave rough.
   c. Where joints are required, bulkhead, key horizontally, and dowel with two No. 5 reinforcing bars, 48 inches 1 200 mm long.
2. Foundations And Walls: Leave steel projecting where required for floor tie.
3. Exterior Slabs:
   a. Dusting with cement not permitted.
   b. For continuous placing and where shown on Drawings, saw cut one inch deep control joints before shrinkage occurs.
4. Equipment Bases: Coordinate with appropriate Sections for locations and dimensions.
5. Anchor Bolts: Place anchor bolts not tied to reinforcing steel immediately following leveling of concrete. Reconsolidate concrete around bolt immediately after placing bolt. Do not disturb bolts during finishing process.

E. Finishing:
1. Rubbed Finish, Exposed Vertical Surfaces:
   a. Immediately after removing forms, remove joints, marks, bellies, projections, loose materials, and cut back metal ties from surfaces to be exposed.
   b. Point up voids with cement mortar, 1:2 mix, and rub exposed surface with carborundum to smooth, even surface.
2. Steel Trowel Finishes, Interior Flatwork:
   a. Float and steel trowel interior slabs after concrete has set enough to avoid bringing water and fines to surface.
   b. If power troweling is used, get approval of finish from Architect.
3. Broom Finishes, Exterior Flatwork Not Specified in Section 03 3053:
   a. Broom finish exterior slabs.
   b. Round edges including edges formed by expansion joints.
   c. Remove edger marks.
4. Rough: Top of slabs and stairs to receive setting bed for ceramic or paver tile.

F. Curing:
1. Interior Slabs:
   a. Water cure as specified in Section 03 3913, unless Cold Weather Concreting Procedures are necessary.
   b. Membrane cure as specified in Section 03 3923, if Cold Weather Concreting Procedures are necessary.
2. Concrete Paving: Membrane cure as specified in Section 03 3923.
3. All Other Concrete Flatwork And Curbs: Membrane cure as specified in Section 03 3923

3.3 FIELD QUALITY CONTROL

A. Inspection: Notify Architect three days minimum before placing concrete for footings, foundation walls, and building slabs.

3.4 ADJUSTING

A. Remedy For Out-of-Tolerance Building Slabs:
1. Remove and replace sections of slabs measuring outside specified correctable tolerances.

3.5 PROTECTION

A. Protect concrete that has not received its initial set from precipitation to avoid excess water in mix and unsatisfactory surface finish.

B. Do not allow materials resulting from construction activities, which will affect concrete or application of finish floor systems adversely, to come in contact with interior concrete slabs.

END OF SECTION

SECTION 03 3923

MEMBRANE CONCRETE CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of membrane concrete curing as described in Contract Documents.

B. Related Sections:
   1. Section 03 3053: Miscellaneous Cast-In-Place Concrete.
   2. Section 03 3111: Normal weight structural concrete.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 309-03, 'Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Exterior:
   1. Low VOC (less than 350 grams per liter), water-borne, membrane forming curing compound meeting requirements of ASTM C 309, Type 2.
      a. Class Two Quality Standard. See Section 01 6200 for definition of Classes.
         1) 1200 White by W. R. Meadows
      b. Class Two Quality Standard. See Section 01 6200 for definition of Classes.
         1) Vocomp 20 Cure and Seal by W. R. Meadows.

B. Interior:
   1. Low VOC (less than 350 grams per liter), water-borne, membrane forming curing compound meeting requirements of ASTM C 309, Type 1D, Class B and containing no mineral spirits, naptha, or other components detrimental to finish flooring installation.
   2. Category Four Approved Manufacturers. See Section 01 6200 for definition of Categories.
      a. Safe Cure & Seal (J-18) by Dayton Superior Chemical Division, Miamisburg, IL www.daytonsuperiorchemical.com.
      b. Soncrete Kure-N-Seal W or WB by Sonneborn, Shokopee, MN www.chemrex.com.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection: Protect surfaces that will be receiving products or systems incompatible with curing compounds. Where such surfaces do receive curing compound, remove to extent required by installer of products and systems to be subsequently installed and at no additional cost to Owner.

END OF SECTION

SECTION 03 4800

PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install precast concrete window sills as described in Contract Documents.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 185-02, 'Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete.'
   2. ASTM A 615-04b, ‘Standard Specification for Deformed and Plain Steel Bars for Concrete Reinforcement.'
   3. ASTM C 33-03, 'Standard Specification for Concrete Aggregates.'
   4. ASTM C 150-04, 'Standard Specification for Portland Cement.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast concrete:
   1. Cement: ASTM C 150, Type II.
   2. Aggregates: ASTM C 33.

B. Reinforcing:
   1. Bars: ASTM A 615, Grade 60.
   2. Reinforcing Mesh: ASTM A 185.

C. Cap And Joint Covers: 30 lb asphalt impregnated felt.

D. Mastic: Asphalt based plastic roofing cement.

2.2 FABRICATION

A. General:
   1. 3000 psi concrete minimum.
   2. Chamfered edges.
   3. Smooth finish free from pits and rock pockets.

B. Window Sills:
   1. 16 inches 400 mm wide by 24 inches 600 mm long by 3 inches 75 mm high.
   2. Formed water trough.
   3. Cast in reinforcing mesh.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Window Sills: Set level at window areas and centered under each window.

END OF SECTION

DIVISION 04: MASONRY

04 0000 MASONRY

04 0516 MASONRY GROUTING
04 0520 MASONRY REINFORCING

04 2000 UNIT MASONRY

04 2223 ARCHITECTURAL CONCRETE UNIT MASONRY

END OF TABLE OF CONTENTS

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SECTION 04 0516

MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of masonry grout used on Project.

B. Related Sections
   1. Sections under 04 2000 heading: Furnish and install masonry grout.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 94-03, 'Standard Specification for Ready-Mixed Concrete.'
   2. ASTM C 150-04, 'Standard Specification for Portland Cement.'
   3. ASTM C 207-01, 'Standard Specification for Hydrated Lime for Masonry Purposes.'
   4. ASTM C 404-03, 'Standard Specification for Aggregates for Masonry Grout.'
   5. ASTM C 1019-03, 'Standard Test Method for Sampling and Testing Grout.'

1.3 SUBMITTALS

A. Quality Assurance / Control:
   1. If pre-blended dry grout is to be used, provide certification from Manufacturer or Supplier verifying that mixes meet specification requirements.
   2. If grout is to be mixed in field, provide written description of proposed procedure for measuring and mixing of materials.

1.4 PROJECT CONDITIONS

A. Project Environmental Requirements: Install grout under same environmental conditions as specified for mortar.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: Meet requirements of ASTM C 150. Use Type II Low Alkali in exterior walls or in walls subject to moisture, unless approved otherwise in writing by Architect.

B. Hydrated Lime: Meet requirements of ASTM C 207, Type S.

C. Aggregate:
   1. Meet requirements of ASTM C 404, Table 1.
      a. Grading Requirements for Fine Aggregate, Natural, Size 2.

Sieve	Sieve	Percent Passing
No. 4	5 000 mm	100
No. 8	2 500 mm	95 - 100

No. 16	1 250 mm	60 - 100
No. 30	630 mm	35 - 70
No. 50	400 mm	15 - 35
No. 100	160	2 - 15

b. Grading Requirements for Coarse Aggregate, Size 8.

Sieve	Sieve	Percent Passing
1/2 Inch	12 500 mm	100
3/8 Inch	10 000 mm	85 - 100
No. 4	5 000 mm	10 - 30
No. 8	2 500 mm	0 - 10
No. 16	1 250 mm	0 - 5

D. Water: Clean and free of acids, alkalis, and organic materials.

E. Admixtures: No additives are allowed which will increase air entrainment. Other additives may be used as approved in writing by Architect before use.

2.2 MIXES

A. Procedure:
1. Use of pre-blended dry grout mix is allowed only with submission of certification that material specification requirements have been complied with.
2. Use method of measuring and mixing materials that will ensure consistently proportioned grout batches throughout installation of masonry work. No measuring of materials by 'shovels full' is permitted for field mixed grout.
3. Batch, mix, and deliver transit-mixed grout in accordance with requirements of ASTM C 94.

B. Proportions by Volume
1. Water: Enough to give creamy pouring consistency, usually slump of between 8 and 10.

Material	Fine Grout		Coarse Grout	
Portland Cement	One cu ft	0.028 cu m	One cu ft	0.028 cu m
Hydrated Lime (optional)	1/10 cu ft	0.0028 cu m	1/10 cu ft	0.0028 cu m
Damp, Loose Sand	2-1/4 to 3 cu ft	0.063 to 0.084 cu m	2-1/4 to 3 cu ft	0.063 to 0.084 cu m
Pea Gravel	none	none	1 to 2 cu ft	0.028 to 0.056 cu m

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use fine grout for cavities 2 inches 50 mm and smaller in smallest dimension. Use coarse grout for cavities greater than 2 inches 50 mm in smallest dimension.

3.2 FIELD QUALITY CONTROL

A. Site Testing: Test grout used in masonry bearing walls in accordance with ASTM C 1019. Test results of 2000 psi minimum are required.

END OF SECTION

SECTION 04 0520

MASONRY REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Masonry horizontal joint reinforcing.
   2. Steel masonry reinforcing bars.

B. Related Sections:
   1. Sections under 04 2000 heading: Installation.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 82-02, 'Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.'
   2. ASTM A 153-01a, 'Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.'
   3. ASTM A 615-04b, 'Standard Specification for Deformed and Plain Steel Bars for Concrete Reinforcement.'
   4. ASTM A 641-98, 'Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.'

1.3 QUALITY ASSURANCE

A. Tag continuous joint reinforcing with Manufacturer's name, wire size, and ASTM / CSA specification.

1.4 DELIVERY, HANDLING, AND STORAGE

A. Steel reinforcing bars shall be free of heavy rust scales and flakes, or other bond-reducing coating at time of delivery and placing. Properly protect rebar on site after delivery.

B. Separate steel reinforcing bars by size and tag with manufacturer's heat or test identification number.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel reinforcing bars shall have grade identification marks and meet requirements of ASTM A 615, Grade 60 minimum. All but No. 2 bars shall be deformed type.

2.2 MANUFACTURED UNITS

A. Continuous Joint Reinforcing:
   1. Conform to ASTM A 82. Exterior wall reinforcing shall be galvanized to meet requirements of ASTM A 153, Class B-2. Interior wall reinforcing shall be galvanized to meet requirements of ASTM A 641, Class A.
   2. Size: 2 inches 50 mm less than nominal thickness of wall.
   3. Rod Size:
      a. Side rods: 9 ga 3 mm.

b. Cross rods: 9 ga 3 mm (unless noted otherwise).

4. Cross Rods: Cross rods that serve as metal ties in exterior cavity and other multi-wythe walls shall be drip crimped.
5. Corners And Tee Sections: Prefabricated of material and design similar to main reinforcement.
6. Class One Quality Standards:
   a. Single-Wythe Masonry: 9 ga 3 mm Dur-O-Wal Truss
   b. Equals by Heckman, Hohmann & Barnard, and Masonry Reinforcing Corp.

B. Rebar Positioners:
1. Class One Quality Standards:
   a. Single Curtain: Dur-O-Wal D/A 811
      1) Equals by Heckman, Hohmann & Barnard, and Masonry Reinforcing Corp.
2. Equal system as approved by Architect before use. See Section 01 6200.

2.3 MANUFACTURERS

A. Contact Information:
1. Dur-O-Wal. Div Dayton/Superior, Arlington Heights, IL www.durowal.com.
2. Heckman Building Products Inc, Chicago, IL www.heckmannbuildingproducts.com.
3. Hohmann & Barnard, Hauppauge, NY www.h-b.com.
4. Masonry Reinforcing Corporation of America, Charlotte, NC www.wirebond.com.

2.4 FABRICATION

A. Fabricate and bend steel reinforcing bars according to 1988 edition of 'ACI Detailing Manual for reinforcing steel fabrication, and details on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: Coordinate with Division 03 for placement of dowels out of foundations for masonry reinforcing.

END OF SECTION

SECTION 04 2223

ARCHITECTURAL CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install architectural concrete unit masonry as described in Contract Documents.
   2. Furnish and install anchor bolts and embedded anchors as described in Contract Documents.
   3. Grout door frames installed in CMU walls.

B. Products Installed But Not Supplied Under This Section:
   1. Section 05 1223: Metal Lintels.
   2. Section 07 7126: Reglets.

C. Related Sections:
   1. Section 05 0523: Quality of anchor bolts.
   2. Section 08 1213: Steel Door Frames.
   3. Section 08 5113 or 08 5313: Windows.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 90-02, 'Standard Specification for Loadbearing Concrete Masonry Units.'
   2. ASTM C 331-04, 'Standard Specification for Lightweight Aggregates for Concrete Masonry Units.'

1.3 SUBMITTALS

A. Quality Assurance / Control: Manufacturer's certification that units meet compressive strength specified requirements.

1.4 QUALITY ASSURANCE

A. Job Mock-Ups:
   1. 4 feet 1 200 mm long by 3 feet 900 mm high of proposed color range, texture, bond, mortar, and workmanship. Show wall construction to be used on Project, including reinforcing, etc.
   2. Do not start work until Architect has accepted sample panel.
   3. Use panel as standard of comparison for masonry work built of same material.

B. Pre-Installation Conference: Schedule pre-installation conference during construction of mock-up.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Check, carefully unload, and deliver material to site in such a manner as to avoid soiling, damaging, or snipping.

B. Store material on planks clear of ground and protect from damage, dirt, or disfigurement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar: Type 'S' mortar as specified in Section 04 0513.

2.2 MANUFACTURED UNITS

A. Concrete Masonry Units:
   1. Meet requirements of ASTM C 90, Type I, moisture control units, lightweight classification.
      a. 85 lbs per cu ft 126 kg per cu meter minimum weight classification.
      b. Lightweight aggregates conforming to ASTM C 331.
      c. Do not use re-crushed masonry units as aggregate.
   2. Outside Corners: Square-edged, except where bull nose is indicated on Drawings.
   3. Use special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, etc, as required.
   4. Uniform color and textures with unbroken edges.
      a. Smooth face for interior walls. Natural Color
      b. Split face for exterior natural color.
      c. Special color smooth exterior at hose bibbs, handicap signs, and electrical devices.

2.3 ACCESSORIES

A. Construction Cleaning Compounds:
   1. Type Two Acceptable Products:
      a. 202 or 202V by Diedrich Technologies, Oak Creek, WI www.diedrichtechnologies.com.
      b. Surekleen No. 600 or Vana-Trol by ProSoCo Inc, Kansas City, KS www.prosoco.com.
      c. Equal as approved by Architect before use. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Site Tolerances:
   1. Masonry work shall be true to vertical and horizontal planes within 1/8 inch 3 mm in 10 feet 3 meters, non-cumulative.
   2. Maintain 3/8 inch 9.5 mm mortar joints throughout.

B. General:
   1. Make cuts proper size to accommodate work of other trades. Cut openings for electrical devices using cover plates no larger than can be covered by standard size plate. Replace unit masonry in which larger than necessary openings are cut. Do not patch openings with mortar or other material.
   2. Step back unfinished work for joining with new work. Use toothing only with Architect's approval.

C. Laying:
   1. Layout:
      a. Running bond except where indicated otherwise. Select brick so there is uniform distribution of hues.
      b. Use solid brick where brick coursing would otherwise show cores.
   2. Joints:
      a. Tool concave. Fill completely except where indicated differently.
      b. Do not tool until mortar has taken initial set.
      c. Point holes in joints. Fill and tool properly.

3. Concrete Masonry Units:
    a. Lay hollow masonry units dry. Do not lay masonry on frozen material.
    b. Align cells or cavities to preserve an unobstructed cavity for grouting.
    c. Full bedding required on both webs and face shell under first course. Other courses need only face shell bedding except where bedding is needed to control the flow of grout. Do not allow excess mortar to block cells receiving grout or foamed-in-place insulation.

D. Reinforcing:
1. Reinforcing shall be free of material that may destroy bond.
2. Masonry Reinforcing Steel:
    a. Place steel as shown on Drawings.
    b. Splice 48 bar diameters minimum.
    c. Place reinforcing and dowels before pouring grout.
    d. Dowel vertical reinforcing bars out of structure below with bars of same size and spacing.
    e. Place horizontal bars in 8 inch 200 mm deep bond beam units at top of wall and at 48 inches 1 200 mm on center between. Continue bond beam units and reinforcement uninterrupted around corners and across wall intersections.
    f. Place special vertical bars of same size as normal vertical reinforcement at corners and jambs of openings and recesses where bond beams are interrupted and at beam bearing locations not otherwise detailed.
    g. Unless detailed otherwise, place special horizontal bars of same size as normal reinforcing above and below openings. Extend bars 24 inches 600 mm minimum beyond opening.
    h. Hold vertical reinforcing in place every 32 inches 800 mm.
3. Rebar Positioners: Before grouting, secure masonry reinforcing steel in place before grouting with rebar positioners at top of first course and bottom of top course minimum. Install intermediary positioners for every 192 bar diameters maximum between positioners. Locate intermediary positioners with approximately equidistant spacing in wall when number required has been determined.

E. Grouting:
1. Fully grout cells containing reinforcing bars.
    a. Place grout in 48 inch 1 200 mm maximum lifts.
    b. Consolidate grout by means of a mechanical vibrator. Do not use cell reinforcing to rod grout.
    c. Before loss of plasticity, mechanically reconsolidate grout.
2. CMU Cells.
    a. Place grout in 48 inch 1 200 mm maximum lifts.
    b. Consolidate grout by means of a mechanical vibrator. Do not use cell reinforcing to rod grout.
    c. Before loss of plasticity, mechanically reconsolidate grout.
3. Grout hollow metal door frames solid.
4. Provide grout-leveling bed for support of wall plates.

3.2 CLEANING

A. After mortar has hardened, wet masonry and clean with specified cleaning compound. Use stiff fibered brush for application. Rinse masonry surfaces with water immediately after cleaning. Leave masonry clean, free of mortar daubs, and with tight mortar joints.

B. Remove and replace defective material at Architect's direction and at no additional cost to Owner.

C. Clean up masonry debris and remove from site.

3.3 PROTECTION

A. Protect masonry with cover during rainy weather.

B. Cover work at end of each workday with tarpaulins if temperature is 25 to 40 deg F minus 4 to 4 deg C. If temperature is below 25 deg F minus 4 deg C, protect with heaters. Maintain temperature around masonry to 40 deg F 4 deg C minimum for 48 hrs if Type I, 24 hrs if Type III, or longer if required.

C. Brace masonry walls until walls attain adequate strength and are tied into building structure.

D. Do not allow structural loading of masonry walls until walls attain adequate strength.

END OF SECTION

DIVISION 05: METALS

05 0000 METALS

05 0503 OFFSITE-APPLIED METAL COATINGS
05 0523 METAL FASTENINGS

05 5000 METAL FABRICATIONS

05 5871 METAL BRACKETS

END OF TABLE OF CONTENTS

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SECTION 05 0503

OFFSITE-APPLIED METAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of factory or shop-applied priming applied to steel supplied to Project without finish coat.
   2. Quality of and procedures for field touch-up and repair of factory-applied priming and galvanizing.

B. Related Sections
   1. Sections under 09 9000 heading: Finish painting.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 780-01, 'Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.'
   2. ASTM B 695-00, 'Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Factory And Shop-Applied Primer: Compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading. Primer on unexposed, unfinished surfaces may be fabricator's standard shop coat.

B. Repairs To Primed Surface: Unless otherwise specified, use primer which matches characteristics of original primer and is compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.

C. Material For Repairs Of Galvanized Surfaces:
   1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
      a. Zinc-Rich Paints:
         1) Zinc-Dust Content: Dried film shall contain 94 percent of zinc-dust by weight.
         2) Type One Acceptable Manufacturers:
            a) Galvax by Alvin Products Inc, Lawrence, MA www.alvinproducts.com.
            b) ZRC Cold Galvanizing Compound by ZRC Chemical Products Co, Quincy, MA www.zincrich.com.
            c) Equal as approved by Architect before bidding. See Section 01 6000.
   2. Structural, Load-Bearing Items And Items Exposed To Weather:
      a. Zinc-Based Solders, Powder, Or Rod:
         1) Zinc-Cadmium solder with liquidus temperature range from 518 to 527 deg F 270 to 275 deg C, or
         2) Zinc-Tin-Lead alloy with liquidus temperature range from 446 to 500 deg F30 to 260 deg C.
      b. Sprayed Zinc: Wire, ribbon, or powdered zinc suitable for process.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
   1. Clean, grind, or otherwise prepare welds in steel that is to be coated within limits acceptable to welder responsible for structural integrity.
   2. Surfaces to be coated shall be clean, dry and free of oil, grease, and corrosion products.

B. Preparation Of Primed, Ungalvanized Surfaces: Clean welds and grind serious abrasions.

C. Preparation Of Galvanized Surfaces:
   1. Follow requirements of ASTM A 780 and following:
   2. For Repair Using Zinc-Rich Paints:
      a. Blast clean surfaces to near-white metal, in accordance with SSPC-SP10 (1 to 2 mil anchor pattern), as minimum.
      b. Where circumstances do not allow blast cleaning, power disk sand to bright metal finish.
      c. Extend surface preparation into undamaged galvanized area.
      d. Remove flux residue and weld spatter from welded areas.
   3. For Repair Using Zinc-Based Alloys:
      a. Clean surface to be reconditioned using wire brush, light grinding action, or mild blasting.
      b. Extend surface preparation into surrounding, undamaged galvanized areas.
      c. Remove flux residue and weld spatter from welded areas.
      d. Preheat cleaned area to at least 600 deg F 316 deg C.
         1) Do not overheat surface beyond 750 deg F 400 deg C or allow surrounding galvanized coatings to be burned.
         2) Wire brush surface during preheating.
   4. For Repair Using Sprayed Zinc (Metallizing):
      a. Blast clean surfaces to near-white metal, in accordance with SSPC-SP5 as minimum.
      b. Extend surface preparation into undamaged galvanized area.
      c. Remove flux residue and weld spatter from welded areas.

3.2 REPAIR / RESTORATION

A. Repairs To Primed, Ungalvanized Surfaces:
   1. Thoroughly clean metal and give one prime coat of specified material, well-worked into metal joints and open spaces. Match existing primed finish as required.
      a. Do not apply primer at temperatures below 45 deg F 7 deg C.
      b. Protect un-primed machine-finished surfaces against corrosion by priming.

B. Repairs To Galvanized Surfaces:
   1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
      a. Repair Using Zinc-Rich Paints: Spray- or brush-apply zinc-rich paint to prepared area. Apply paint in single application employing multiple spray passes to achieve dry film thickness of 2 mils.
   2. Structural, Load-Bearing Items And Items Exposed To Weather:
      a. Repair Using Zinc-Based Alloys:
         1) Rub cleaned, pre-heated areas with repair stick to deposit evenly distributed layer of zinc alloy. If powdered zinc alloys are used, sprinkle powder on surface and spread out with spatula or similar tool.
         2) Remove flux residue by rinsing with water or wiping with damp cloth.
      b. Repair Using Sprayed Zinc (Metallizing): Apply 2 mil minimum coating by means of metal-spraying pistols fed with either zinc wire or zinc powder in accordance with requirements of ASTM B 695, Type I.
   3. All Items:
      a. Apply repair materials immediately after surface preparation is complete.

b. Take thickness measurements, with either magnetic or electromagnetic gauge, to ensure applied coating is as specified or agreed to.

END OF SECTION

B L A N K P A G E

SECTION 05 0523

METAL FASTENING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of structural bolts used on Project.
   2. Requirements and standards for site welded metal-to-metal connections.

B. Related Sections:
   1. Furnishing and installing of structural bolts specified under Section concerned.
   2. Performance of welding specified under Section concerned.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 36-03a, 'Standard Specification for Carbon Structural Steel.'
   2. ASTM A 108-99, 'Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.'
   3. ASTM A 307-03, 'Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.'
   4. ASTM A 325-02, 'Standard Specification for High-Strength Bolts for Structural Steel Joints.'
   5. ASTM A 496-02, 'Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.'

B. American Welding Society / American National Standards Institute:
   1. AWS / ANSI D1.1-2003, 'Structural Welding Code - Steel.'
   2. AWS / ANSI D1.3-1998, 'Structural Welding Code - Sheet Steel.'

1.3 QUALITY ASSURANCE

A. Qualifications: Welders shall be certified 30 days minimum before beginning work on Project. If there is doubt as to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Pittsburgh Laboratories or other authority approved by Architect.

B. Certifications: Maintain welder's certifications on job-site.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Bolts And Threaded Fasteners:
   1. Bolts:
      a. Anchor Bolts: Non-headed type threaded 2 inches 50 mm minimum conforming to ASTM A 307, Grade A. Anchor hook to project 2 inches 50 mm minimum including bolt diameter.
      b. All Other Bolts: Conform to requirements of ASTM A 307, Grade A.

B. Arc-Welding Electrodes: Type E70XX AWS Iron and Steel Arc-welding electrodes and meeting current AISC Specifications.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Installation of bolts shall meet AISC requirements.

END OF SECTION

SECTION 05 5871

METAL BRACKETS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Metal brackets necessary to support seats in Shower Rooms.

B. Related Sections:
   1. Section 05 0503: Quality of priming.
   2. Section 05 0523: Quality of welding.
   3. Section 06 2001: Installation.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 36-03a, 'Standard Specification for Carbon Structural Steel.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Meet requirements of ASTM A 36.

2.2 FABRICATION

A. Fabricate as detailed.

B. Grind exposed welds smooth and polish to match non-welded metal finish.

C. After fabrication and drilling of mounting holes, shop prime.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

DIVISION 06: WOOD, PLASTICS, AND COMPOSITES

06 1000 ROUGH CARPENTRY

06 1011 WOOD FASTENINGS
06 1100 WOOD FRAMING
06 1636 WOOD PANEL PRODUCT SHEATHING
06 1753 SHOP-FABRICATED WOOD TRUSSES: TRUSSED RAFTERS

06 2000 FINISH CARPENTRY

06 2210 MISCELLANEOUS WOOD TRIM

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SECTION 06 1011

WOOD FASTENINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of wood fastening methods and materials unless specified otherwise.

B. Related Sections:
   1. Section 05 0523: Quality of bolts used on Project.
   2. Furnishing and installing of fasteners specified in individual Sections where installed.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM F 1667-02a, 'Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.'

1.3 DEFINITIONS

A. Nail Terminology:
   1. When following nail terms are used in relation to this Project, following lengths and diameters will be understood. Refer to nails of other dimensions by actual length and diameter, not by one of listed terms:

Nail Term	Length	Diameter	Length	Diameter
8d Box	2-1/2 inches	0.113 inch	63.5 mm	2.827 mm
8d Common	2-1/2 inches	0.131 inch	63.5 mm	3.389 mm
10d Box	3 inches	0.128 inch	76.2 mm	3.251 mm
10d Common	3 inches	0.148 inch	76.2 mm	3.759 mm
16d Box	3-1/2 inches	0.135 inch	88.9 mm	3.411 mm
16d Sinker	3-1/4 inches	0.148 inch	82.6 mm	3.759 mm
16d Common	3-1/2 inches	0.162 inch	88.9 mm	4.115 mm

PART 2 -

PART 3 - PRODUCTS

3.1 MATERIALS

A. Fasteners:
   1. Fasteners in contact with preservative treated wood shall be hot-dipped galvanized or G-185 coated.
   2. Nails:
      a. Meet requirements of ASTM F 1667.
      b. Unless noted otherwise, nails listed on Drawings or in Specifications shall be common nail diameter, except 16d nails, which shall be box diameter.
   3. Wood Screws: Standard type and make for job requirements.

4. Powder-Actuated Fasteners:
   a. Class Two Quality Standard: Hilti X-DNI 62P8.
   b. Manufacturers:
      1) Hilti, Tulsa, OK www.hilti.com.
      2) Ramset / Redhead Division of ITW, Wood Dale, IL www.ramset-redhead.com and Markham, ON www.itwconstruction.ca.
      3) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6000.
5. Expansion Bolts:
   a. Type Two Acceptable Products:
      1) Kwik Bolt 3 by Hilti, Tulsa, OK www.hilti.com.
      2) Trubolt by Ramset / Redhead Division of ITW, Wood Dale, IL www.ramset-redhead.com and Markham, ON www.itwconstruction.ca.
      3) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6000.
6. Screw Anchors:
   a. Type Two Acceptable Products:
      1) HUS-H Screw Anchor by Hilti, Tulsa, OK www.hilti.com.
      2) Titen HD by Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
      3) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6000.

B. Adhesives:
   1. Construction Mastics: Meet requirements of American Plywood Association Specification AFG-01 September 1974. Use phenol-resorcinol type for use on pressure treated wood products.

C. Framing Anchors:
   1. Framing anchors and associated fasteners in contact with preservative treated wood shall be hot-dipped galvanized, G-185 coated, or stainless steel. However, do not use stainless steel items with galvanized items.
   2. Type Two Acceptable Products:
      a. Advanced Connector Systems (ACS), Tempe, AZ www.acsboss.com.
      b. KC Metals Inc, San Jose, CA www.kcmetals.com.
      c. Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
      d. United Steel Products Co Inc (USP), Montgomery, MN www.uspconnectors.com.
      e. Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6000.

PART 4 - EXECUTION

4.1 ERECTION

A. Secure one Manufacturer approved fastener in each hole of framing anchor that bears on framing member unless approved otherwise in writing by Architect. 'Boss' system by ACS is acceptable nailing system for framing anchors.

B. Provide bolt heads and nuts bearing on wood with washers.

END OF SECTION

SECTION 06 1100

WOOD FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install wood framing and blocking as described in Contract Documents.

B. Products Installed But Not Supplied Under This Section:
   1. Miscellaneous structural steel elements.
   2. Wood trusses.

C. Related Sections:
   1. Section 05 1223: Furnishing of miscellaneous structural steel.
   2. Section 06 0573: Quality of Preservative Wood Treatment.
   3. Section 06 1753: Furnishing of wood trusses.

1.2 REFERENCES

A. Truss Plate Institute:
   1. TPI / WTCA Booklet BCSI-03, 'Guide for Handling, Installing, Installing, and Bracing of Metal Plate Connected Wood Trusses.'

B. U. S. Department of Commerce:
   1. Voluntary Product Standard DOC PS 20-99, 'American Softwood Lumber Standard.'

C. Canadian Standards Association:
   1. CAN / CSA-O86.1-M89, ‘Engineering Design in Wood (Limit States Design).‘
   2. CAN / CSA-O141-91, ‘Softwood Lumber.‘
   3. CAN / CSA-O151-M1978, ‘Canadian Softwood Plywood.‘

1.3 SUBMITTALS

A. Quality Assurance / Control:
   1. Technical and engineering data on nails to be set by nailing guns for Architect's approval of types proposed to be used as equivalents to specified hand set nails and adjusted number and spacing of pneumatically-driven nails to provide equivalent connection capacity.
   2. Copies of pamphlets specified in REFERENCE Article. After Architect's examination, keep pamphlets on Project site with approved shop drawings. Pamphlets may be obtained from Truss Plate Institute, Wood Truss Council of America, or from Truss Fabricator.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect lumber and plywood and keep under cover in transit and at job site.

B. Do not deliver material unduly long before it is required.

C. Store lumber and plywood on level racks and keep free of ground to avoid warping. Stack to insure proper ventilation and drainage.

D. Handle and store wood trusses in accordance with TPI / WTCA Booklet BCSI, except trusses may be unloaded by dumping if trusses are shipped horizontally, are rolled off low profile roller bed trailer, and no part of any truss is required to drop more than 18 inches 450 mm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dimension Lumber:
   1. Meet requirements of PS 20 and National Grading Rules for softwood dimension lumber.
   2. Bear grade stamp of WWPA, SPIB, or other association recognized by American Lumber Standards Committee identifying species of lumber by grade mark or by Certificate of Inspection.
   3. Identify lumber and plywood by grade mark or Certificate of Inspection issued by approved lumber grading or inspection bureau or agency. Graded American lumber may be used, subject to CLSAB approval.
   4. Lumber 2 inches 50 mm or less in nominal thickness shall not exceed 19 percent in moisture content at time of fabrication and installation and be stamped 'S-DRY', 'K-D', or 'MC15.'
   5. Lumber shall be S4S.
   6. Preservative Treated Plates / Sills:
      a. 2x4 38 mm by 64 mm: Standard and better Douglas Fir, Southern Pine, or HemFir, or StrandGuard by Trus Joist, Boise, ID www.tjm.com.
      b. 2x6 38 mm by 140 mm And Wider: No. 2 or or MSR 1650f - 1.5e Douglas Fir, Southern Pine, HemFir, or StrandGuard by Trus Joist, Boise, ID www.trusjoist.com.

B. Blocking: Sound lumber without splits, warps, wane, loose knots, or knots larger than 1/2 inch 13 mm.

C. Sill Sealer: Closed-cell polyethylene foam, 1/4 inch 6 mm thick by width of plate.

PART 3 - EXECUTION

3.1 ERECTION

A. General: Use preservative treated wood for wood members in contact with concrete or masonry, including wall, sill, and ledger plates, door and window subframes and bucks, etc.

B. Interface With Other Work:
   1. Coordinate with other Sections for location of blocking required for installation of equipment and building specialties. Do not allow installation of gypsum board until required blocking is in place.
   2. Where manufactured items are to be installed in framing, provide rough openings of dimensions within tolerances required by manufacturers of such items. Confirm dimensions where not shown on Drawings.

C. Walls:
   1. Top Plates In Bearing Partitions: Doubled or tripled and lapped. Stagger joints at least 48 inches 1 200 mm.

      a. Top plates: Spiked together, 16d, 16 inches 400 mm on center.
      b. Top plates: Laps, lap members 48 inches 1200 mm minimum and nail with 16d nails 4 inches 100 mm on center
      c. Top plates: Intersections, three 16d.
      d. Backing And Blocking: Three 8d, each end.

D. Roof And Ceiling Framing:
   1. Install structural blocking and bridging as necessary and as described in Contract Documents.
   2. Special Requirements:
      a. Roof And Ceiling Joists: Lap joists 4 inches 100 mm minimum and secure with code approved framing anchors.
      b. Roof Rafters And Outlookers :
         1) Cut level at wall plate and provide at least 2-1/2 inches 64 mm bearing where applicable. Spike securely to plate with three 16d nails.
         2) Attach to trusses or other end supports with framing anchors described in Contract Documents.
         3) Provide for bracing at bearing partitions.
   3. Installation of Wood Trusses:
      a. Handle, erect, and brace wood trusses in accordance with TPI / WTCA Booklet BCSI.
      b. Do not install damaged or broken wood trusses. Replace wood trusses that are broken, damaged, or have had members cut out during course of construction.
      c. Provide construction bracing for trusses in accordance with TPI DSB-89.
      d. Provide continuous 2x4 horizontal web bracing as shown on truss shop drawings.
         1) Secure bracing to each truss with two 10d or 16d nails.
         2) Lap splice bracing by placing bracing members side by side on common web member. Butt splices are not acceptable.
      e. Unless directed or shown otherwise, provide diagonal 2x4 bracing between trusses at each line of horizontal web bracing.
         1) This diagonal bracing shall be continuous and extend from junction of web and top chord of one truss to junction of web and bottom chord of different truss.
         2) Install bracing at approximately 45 degree angle. Bracing will extend over three trusses minimum or more as determined by height of trusses and 45 degree installation angle.
         3) Install brace on side of web opposite horizontal web bracing and nail to each web with two 10d or 16d nails.
         4) Install one brace every 20 feet as measured from top of brace to top of next brace.

E. Accessory / Equipment Mounting And Gypsum Board Back Blocking (nailers):
   1. Furnish and install blocking in wood framing required for hardware, specialties, equipment, accessories, and mechanical and electrical items, etc.
   2. Furnish and install back blocking in wood framing required for joints in gypsum wallboard.
      a. Install back blocking between I-joist framing members with equivalent of Simpson Z2 clips attached with four 10d x 1-1/2 inch nails at each end, two into I-joist and two into blocking.
      b. Attach back blocking at trusses, stick framing, or walls with two 10d nails in each end of each piece of blocking.

END OF SECTION

B L A N K P A G E

SECTION 06 1636

WOOD PANEL PRODUCT SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install wood panel product sheathing required for walls, roofs, and floors as described in Contract Documents.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Protect sheathing and keep under cover in transit and at job site.

B. Do not deliver material unduly long before it is required.

C. Store sheathing on level racks and keep free of ground. Stack to insure proper ventilation and drainage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheathing:
   1. Meet requirements of PS 1-95, PS 2-92, PRP-108 (APA), or PRP-133 (TECO). Except where plywood is specifically indicated on Drawings, oriented strand board (OSB) is acceptable.
   2. Every sheet of sheathing shall be stamped as follows:
      a. Appropriate APA, TECO, or PFS grade stamp identifying thickness and span rating.
   3. Sheathing shall not exceed 18 percent moisture content when fabricated or more than 19 percent when installed in Project.
   4. Sheathing used for same purpose shall be of same thickness. In all cases, thickness specified is minimum required regardless of span rating.
   5. Minimum span ratings for given thicknesses shall be as follows:

B. Nails:
   1. 15/32 inch 11.9 mm and thicker panels: 10d common or galvanized box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Top of nail heads shall be flush with sheathing surface.
   2. Use of edge clips to provide spacing between sheathing panels is acceptable.
   3. Place nails at least 3/8 inch 9.5 mm in from edge.

B. Roof Sheathing:

1. Placing:
    a. Lay face grain at right angles to supports. Provide blocking for support where framing turns at roof overhang.
    b. Provide 1/8 inch 3 mm space between sheets at end and side joints.
    c. Stagger panel end joints.
    d. Sheathing shall be continuous of two spans minimum.
2. Size:
    a. 5/8 inch actual minimum thickness.
    b. Do not install any piece of roof sheathing with shortest dimension of less than 24 inches 600 mm.

3.2 PROTECTION

A. Protect roof sheathing from moisture until roofing is installed.

END OF SECTION

SECTION 06 1753

SHOP-FABRICATED WOOD TRUSSES: Trussed Rafters

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Wood roof trusses
   2. Trussed blocking for roof trusses

B. Related Sections
   1. Section 06 1100:
      a. Storage and handling of trusses on Project site
      b. Installing, securing, bracing, etc
      c. Required blocking other than trussed blocking

1.2 REFERENCES

A. American National Standards Institute / Truss Plate Institute:
   1. ANSI / TPI 1-2002, ‘National Design Standard For Metal Plate Connected Wood Truss Construction.’

B. Truss Plate Institute:
   1. TPI / WTCA Booklet BCSI-03, 'Guide for Handling, Installing, Installing, and Bracing of Metal Plate Connected Wood Trusses.'

1.3 SUBMITTALS

A. Shop Drawings:
   1. Base shop drawings on truss configurations and on truss loads shown on Drawings and on requirements of Contract Documents. Joint configurations may be modified to allow double cut webs. Determine member forces from exact analysis method as defined by TPI.
   2. Include following information on submitted shop drawings:
      a. Allowable loads in lbs per effective nail or lbs per sq inch for lumber and plates used as allowed by ICBO and current ICBO report number.
      b. Stress reduction factors used for plates and lumber.
      c. Top and bottom chord design loads in psf.
      d. Size, thickness, and exact location by dimension of plates.
      e. Lumber species and grades used.
      f. Combine stress ratio for each member.
      g. Stamp and signature of Engineer responsible for preparation of shop drawings.
      h. Name and trademark of Plate Manufacturer if metal plates are used.
      i. Name and address of Truss Fabricator and Project name and address.

B. Quality Assurance / Control: Copies of previous four quarterly inspection reports verifying compliance with TPI regulations.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Truss Fabricator shall have in place a program requiring fabrication plant to be inspected four times each year by an independent testing laboratory in accordance with TPI regulations.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Notify Architect two days minimum before arrival of trusses to allow for scheduling of truss inspection on site before unloading and for monitoring of unloading procedure.

B. Unload trusses by one of following methods.
   1. As outlined in TPI / WTCA Booklet BCSI.
   2. Trusses may be unloaded by dumping if trusses are shipped horizontally, are rolled off low profile roller bed trailer, and if no part of any truss is required to drop more than 18 inches 450 mm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Top And Bottom Chords And Web Members:
   1. Douglas Fir or Southern Pine No. 2 or better.
   2. 2 inch by 4 inch nominal minimum size.
   3. Sizes, species, and grades of members shall be as required to provide combined stress ratios of less than one.
   4. Designed in accordance with ANSI / TPI-1 and IBC for given design loads.

B. Metal Gusset Plates
   1. Plate design and manufacture shall be as approved by 'The Research Committee for the ICBO'. Plates shall be galvanized or otherwise protected from corrosion.
   2. Manufacturer's name or trademark shall be visible on plates.
   3. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories.
      a. Alpine Engineered Products Inc, Pompano Beach, FL.
      b. Alpine Systems Corporation, Concord, ON.
      c. CompuTrus Inc, Riverside, CA.
      d. Gang-Nail Canada Inc, Bradford, ON.
      e. Jager Industries Incorporated, Calgary, AB.
      f. MiTek Industries, Chesterfield, MO.
      g. Robbins Manufacturing Co, Tampa, FL.
      h. Tee-Lok Corp, Edenton, NC.
      i. Truswal Systems Corp, Arlington, TX .

2.2 FABRICATION

A. General:
   1. Fabrication of trusses shall be as approved by ICC or ICBO except that this Specification shall govern when it exceeds ICC requirements.
   2. Fabricate trusses from approved shop drawings.
   3. Fabricate trusses in jigs with members accurately cut to provide good bearing at joints. Joints shall be acceptable if the average opening between ends of members immediately after fabrication is less than 1/16 inch 1.6 mm.
   4. Each chord section shall be involved in two panel points before being spliced.
   5. Type One Acceptable Fabricators:
      a. A-Truss.
      b. BMC West.

c. Sunroc.
d. Equal as approved by Architect before bidding. See Section 01 6000.

B. Metal Gusset Plates:
1. No panel point shall have more than one plate per truss side
2. Plates shall have minimum bite of 2-1/2 inches 63 mm on members. Measure bite along center line of webs and perpendicular to chord axes. Orient plate axis parallel with truss chord axis except where chords change pitch or terminate. Plates may be placed parallel with webs at single web joints.
3. Plate Sizes:
   a. Minimum width of plates shall be 3 inches 75 mm.
   b. Trusses Other Than Scissor Trusses: Size plates, nail and steel section, for 125 percent of member forces.
   c. Scissor Trusses: Size plates, nail and steel section, for 150 percent of member forces.
   d. No increase in plate values will be allowed for duration of loading or other factor.
4. Press plates into members to obtain full penetration without crushing outer surface of wood. Plate embedment is acceptable if opening between plate and wood surface is less than 1/32 inch 1 mm.
5. Lumber defects and plate misplacement, in combination, shall not reduce plate area or number of effective teeth, prongs, or nails by more than ten percent.
6. Do not apply metal gusset plates after shop fabrication.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 06 2210

MISCELLANEOUS WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install wood trim not specified elsewhere as described in Contract Documents.

B. Related Sections:
   1. Section 06 2001: Common Finish Carpentry Requirements.
   2. Section 06 4512: Architectural Woodwork Wood Trim.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Meet requirements of Section 06 4001.
   1. Opaque Finished Softwood: Solid stock Pine, C or better, S4S.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

DIVISION 07: THERMAL AND MOISTURE PROTECTION

07 1000 DAMPPROOFING AND WATERPROOFING

07 1113 BITUMINOUS DAMPPROOFING

07 2000 THERMAL PROTECTION

07 2113 BOARD INSULATION
07 2116 BLANKET INSULATION
07 2123 POUR-IN MASONRY INSULATION
07 2613 ABOVE-GRADE VAPOR RETARDERS
07 2616 BELOW-GRADE VAPOR RETARDERS

07 6000 FLASHING AND SHEET METAL

07 6100 SHEET METAL ROOFING
07 6311 METAL SOFFIT
07 6322 STEEL FASCIA

07 7000 ROOF AND WALL SPECIALTIES AND ACCESSORIES

07 7226 RIDGE VENTS

07 9000 JOINT PROTECTION

07 9213 ELASTOMERIC JOINT SEALANTS

END OF TABLE OF CONTENTS

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SECTION 07 1113

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and apply bituminous dampproofing to exterior of foundation walls and top of associated footings.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Maintain dampproofing at 40 deg F 4 deg C or above before application.

1.3 PROJECT CONDITIONS

A. Project Environmental Requirements: Do not apply when ambient temperature is below 40 deg F 4 deg C, surface temperature is below 33 deg F one deg C, or when rain is expected before applied dampproofing will dry.

1.4 SCHEDULING

A. Do not backfill against bituminous dampproofing for 24 hours after application.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type Two Acceptable Products:
   1. Ecomul-11 by Epro Waterproofing Systems, Derby, KS www.eproserv.com.
   2. Henry 788 by Henry Company, Huntington Park, CA www.henry.com.
   3. Karnak 100 by Karnak Chemical Corp, Clark, NJ www.karnakcorp.com.
   4. Sealmastic Asphalt Emulsion Dampproofing Type I by W R Meadows, Hampshire, IL www.wrmeadows.com.
   5. Equal as approved by Architect before application. See Section 01 6200.

PART 3 - EXECUTION

3.1 APPLICATION

A. Spray Application: Spray to a thickness of 10 mils minimum.

B. Brush / Roller Application: Apply two coats of dampproofing at rate recommended by Manufacturer. Apply coats in cross hatch method so coats are applied perpendicular to each other. Before applying second coat allow first coat to dry in accordance with Manufacturer's recommendations.

C. Apply dampproofing to cover area from 6 inches below finish grade line down to and including top of footings.

END OF SECTION

SECTION 07 2113

BOARD INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install board insulation on interior side of perimeter foundation walls and under floor slabs as described in Contract Documents.

B. Products Installed But Not Supplied Under This Section:
   1. Polyethylene Film Vapor Retarder

C. Related Sections:
   1. Section 07 2613: Furnishing of polyethylene film vapor retarder.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 578-01, 'Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.'
   2. ASTM C 1289-01, 'Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type 1 Insulation: Below Grade:
   1. Meet requirements of ASTM C 578, Type IV.
   2. Type One Acceptable Products:
      a. Amofoam CM by Pactiv Building Products, Lake Forest, IL www.pactiv.com/green-guard.
      b. Foamular 250 by Owens Corning, Toledo, OH www.owens-corning.com.
      c. Styrofoam SM by Dow Chemical, Midland, MI www.dow.com.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

B. Adhesive For Type 1 Insulation:
   1. Type Two Acceptable Products:
      a. Pro Series QB-300 by Ohio Sealants, Mentor, OH www.osiproseries.com.
      b. Equal as approved by Architect before use. See Section 01 6200.

2.2 SOURCE QUALITY CONTROL

A. Insulation shall be manufactured to be in compliance with UBC or other applicable building codes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install insulation in compliance with UBC or other applicable building codes.

B. Type 1 Insulation:
   1. Remove ties and concrete protrusions that would keep insulation from fully contacting foundation wall face.
   2. Install against interior side of perimeter foundation walls extending downward from bottom of slab to top of footing. Install using 3/8 inch9 mm beads of specified adhesive at 12 inches 300 mm on center vertically and at each vertical and horizontal joint to completely seal insulation.
   3. Install horizontally under building slab continuously around building perimeter.

END OF SECTION

SECTION 07 2116

BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install unfaced thermal batt insulation in attic.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 665-01, 'Standard Specification for Mineral-Fiber Thermal Insulation For Light Frame Construction and Manufactured Housing.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Thermal And Acoustic Insulation:
   1. Unfaced Insulation: Meet requirements of ASTM C 665, Type I.
   2. Order insulation by 'R' factor rather than 'U' factor, rating, or thickness, either 16 or 24 inches 400 or 600 mm wide according to framing spacing.
   3. 'R' Factor Required:

      a. Thermally Insulated Ceilings / Roof:
         1) R38 Cathedral / High Density: At 2x12 Overbuild Framing.
   4. Type One Acceptable Manufacturers:
      a. Certainteed Corp, Valley Forge, PA www.certainteed.com.
      b. Guardian Fiberglass, Albion, MI www.guardianfiberglass.com.
      c. Knauf Fiber Glass, Shelbyville, IN www.knaufusa.com.
      d. Owens-Corning Fiberglass Corporation, Toledo, OH www.owens-corning.com.
      e. Johns Manville, Denver, CO www.jm.com.
      f. Thermafiber, Wabash, IL www.thermafiber.com.
      g. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 SOURCE QUALITY CONTROL

A. Insulation shall be manufactured to be in compliance with IBC or other applicable building codes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Leave no gaps in insulation envelope.

2. If two layers of insulation are used to attain required 'R' factor, only layer towards interior of building shall have facing.

B. In Framing:
1. Install baffles between trusses and rafters at ventilation spaces if necessary to prevent insulation from blocking airflow from soffit.

END OF SECTION

SECTION 07 2123

POUR-IN MASONRY INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install thermal pour-in masonry insulation in ungrouted CMU cells.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Thermal Insulation:
   1. Meet requirements of ASTM C 764, Type I.
   2. Type One Acceptable Manufacturers:
      a. Certainteed Corp, Valley Forge, PA www.certainteed.com.
      b. Guardian Fiberglass, Albion, MI www.guardianfiberglass.com.
      c. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com.
      d. Owens-Corning Fiberglass Corporation, Toledo, OH www.owens-corning.com.
      e. Johns Manville, Denver, CO www.jm.com.
      f. Thermafiber, Wabash, IL www.thermafiber.com.
      g. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 SOURCE QUALITY CONTROL

A. Insulation shall be manufactured to be in compliance with IBC or other applicable building codes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in compliance with requirements of ASTM C 1015.

B. Fill all ungrouted CMU cells.

END OF SECTION

B L A N K P A G E

SECTION 07 2613

ABOVE-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install polyethylene film vapor retarders on framed ceilings.

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM D 4397-02, 'Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Retarder: 6 mil minimum clear polyethylene sheets meeting requirements of ASTM D 4397.

2.2 ACCESSORIES

A. Lap Sealant:
   1. Type Three Acceptable Products:
      a. Narrow Joint Sealer by Schnee-Morehead Inc, Irving, TX www.trustsm.com.
      b. Equal as approved by Architect before use. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install using 1/2 inch 13 mm long minimum staples through thin cardboard disc or strip reinforcement. Staple every 6 inches 150 mm along structural members and blocking and 3 inches 75 mm in from sheet edge. Run long edge of sheet along structural members.

B. Bed joints in specified sealant or seal with vapor resistant tape of type recommended by Manufacturer for vapor retarder installation.

C. Seal penetrations through vapor retarder immediately before installation of gypsum board.

3.2 FIELD QUALITY CONTROL

A. Inspection:
   1. Vapor retarder is to be air tight and free from holes, tears, and punctures.

a. Immediately before installation of gypsum board, inspect vapor retarder for holes, tears, and punctures and repair damaged areas.
b. Immediately before completion of Project, inspect exposed vapor retarder for holes, tears, and punctures and repair damaged areas.

END OF SECTION

SECTION 07 2616

BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Vapor retarder, seam tape, and penetration accessories for installation under interior slabs-on-grade.

B. Related Sections:
   1. Section 31 2324: Installation.

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM E 96-00, 'Standard Test Methods for Water Vapor Transmission of Materials.'
   2. ASTM E 154-99, 'Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.'
   3. ASTM E 1643-98, 'Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.'
   4. ASTM E 1745-97 (2004), 'Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Retarder:
   1. Conform to requirements of ASTM E 1745, Class A minimum with a low density polyethylene membrane.
   2. Category Four Approved Products:
      a. Moistop Ultra 10 or 15 by Fortifiber, Reno, NV www.fortifiber.com.
      b. Griffolyn 10 or 15 mil by Reef Industries, Houston, TX www.reefindustries.com.
      c. VaporBlock 10 or 15 by Raven Industries, Sioux Falls, SD www.ravenind.com.
      d. Stego Wrap 10 or 15 mil by Stego Industries, San Juan Capistrano, CA www.segoindustries.com.
      e. Perminator 10 or 15 mil by W R Meadows, Hampshire, IL www.wrmeadows.com.

2.2 ACCESSORIES

A. Seam Tape: As recommended by Membrane Manufacturer for continuous taping of seams and sealing of penetration boots.

B. Penetration Boots at Utility Penetrations:
   1. Moistop And Reef Industries: Factory fabricated pipeboots.
   2. All Others: Field fabricated from same material as vapor retarder membrane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with ASTM E 1643, except where Contract Documents indicate otherwise.

END OF SECTION

SECTION 07 6100

SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install metal roofing system as described in Contract Documents.
   2. Furnish and install ice and water shield on entire roof sheathing prior to metal roof.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Roof construction shall carry UL Construction Uplift Rating of at least Class 90.

1.3 SUBMITTALS

A. Product Data: Manufacturer's literature.

B. Shop Drawings: Show all aspects of installation and accessories.

1.4 WARRANTY

A. 20-year minimum guarantee on weather tightness of roof system.

B. Manufacturer's written 20-year guarantee for finishes.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Roofing Panels: Green to match latest restroom.
   1. Metal shall be galvanized 24 ga 0.635 mm steel minimum. Accessories to include edge flashings.
   2. Finish:
      a. Face coating polyvinyledene Fluoride (PVF_2) Resin-base finish (Kynar 500 or Hylar 5000) for coil coating components containing 70 percent minimum PVF_2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
      b. Reverse side coating thermo-cured system consisting of corrosion inhibiting epoxy primer applied over properly pre-treated metal.
      c. Color as selected by Architect from Manufacturer's standard colors.
   3. Fasteners shall be concealed.

B. Ice and water shield by Grace Manufacturer or equal.

2.2 ACCEPTABLE MANUFACTURERS

A. Quality / Style Standard: Standing seam or square batten.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roofing and ridge vents as shown in Manufacturer's details and specifications modified for this Project.

B. Install filter material at ridge vent and under hip flashing.

C. All metal shall be hemmed and bent to avoid oil canning.

END OF SECTION

SECTION 07 6311

METAL SOFFIT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install metal soffit as described in Contract Documents.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 653-01, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.'
   2. ASTM A 792-03, ‘Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.’

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Perforated Soffit:
      a. Installed soffit system shall meet minimum required structural loading conditions when tested in accordance with Test Method No. 4 of AAMA Specification 1402-86.
      b. Face finish shall meet performance requirements of Test Method No. 6 of AAMA Specification 1402-86. Reverse side coating shall pass requirements of paragraphs 1.1 through 1.4 of Test Method No. 6.

1.4 WARRANTY

A. Manufacturer's written 20-year guarantee for finish.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Perforated Aluminum Soffit: Beige to match existing restroom.
   1. Panels:
      a. 0.019 inch 0.48 mm thick minimum.
      b. 'V' groove design complete with matching trim.
      c. Panels shall be interlocked full length of panel.
      d. Perforated full width of panel with holes designed so one dimension does not exceed 1/8 inch 3 mm.
      e. Finish: Double baked enamel to meet or exceed specifications of MIL-C-5541 and FHA BULLETIN UM 27 with protective coating on back side.
      f. CGSB-93.2 with protective coating on back side.
      g. Color as selected by Architect from Manufacturer's standard colors.
      h. Type One Acceptable Manufacturers:

1) Alcoa Building Products, Sidney, OH www.alcoa.com/alcoahomes.
2) Alside Inc, Cuyahoga Falls, OH www.alside.com.
3) Gentek Building Products, Cleveland, OH www.gentekinc.com.
4) Norandex, Cleveland, OH www.norandex.com.
5) Petersen Aluminum Corp, Elk Grove, IL www.pac-clad.com.
6) System 3-12L by Rollex, Elk Grove Village, IL www.rollex.com.
7) Equal as approved by Architect before bidding. See Section 01 6200.

2. Fastening Devices:
   a. 1-1/4 inch 32 mm galvanized staples or as recommended by Soffit Manufacturer.
   b. Non-corrosive screws of length and type recommended by Soffit Manufacturer.

B. Soffits Panels:
1. Materials:
   a. 0.032 inch 0.8 mm thick minimum 3105-H24 alloy aluminum
   b. 24 ga galvanized iron or steel meeting requirements of ASTM A 653, G 90.
   c. 24 ga minimum 50 ksi galvalume steel meeting requirements of ASTM A 792 AZ-55.
2. Flush panel design with stiffening beads. Panels shall be interlocked full length of panel. Panel widths shall be Manufacturer's standard.
3. Finish:
   a. Polyvinyledene Fluoride (PVF_2) Resin-base (Kynar 500 or Hylar 5000) finish for coil coating components containing 70 percent minimum PVF_2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
   b. Color as selected by Architect from Manufacturer's standard colors.
4. Performance Standard: Englert Series 4000 Soffit Panel System.
5. Type One Acceptable Manufacturers:
   a. AEP / Span, Dallas, TX www.aep-span.com.
   b. ATAS Aluminum Products, Allentown, PA www.atas.com.
   c. Copper Sales Inc, Anoka, MN www.unaclad.com.
   d. Englert Inc, Perth Amboy, NJ www.englertinc.com.
   e. Fabral, Lancaster, PA www.fabral.com.
   f. Fashion Inc, Ottawa, KS www.fashioninc.com.
   g. Integris Metals, Minneapolis, MN www.integrismetals.com.
   h. Petersen Aluminum Corp, Elk Grove, IL www.pac-clad.com.
   i. Equal as approved by Architect before bidding. See Section 01 6200.
6. Fastening Devices: 1-1/2 inch 38 mm cadmium or zinc plated ring shanked nails.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conceal fasteners where possible. Paint heads of exposed fasteners to match background.

B. Isolate from dissimilar metals to prevent electrolytic action.

C. Repair buckling or bowing due to improper installation at no cost to Owner.

END OF SECTION

SECTION 07 6322

STEEL FASCIA

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install metal fascia as described in Contract Documents. To match sheet metal roofing.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 653-002a, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.'
   2. ASTM A 792-03, 'Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.'

1.3 WARRANTY

A. Manufacturer's written 20-year guarantee for finish.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fascia: Green to match roof metal.
   1. Steel:
      a. Minimum 24 ga, hot-dipped galvanized to meet requirements of ASTM A 653, 1.25 oz/sq ft or galvalume meeting requirements of ASTM A 792 AZ50, 50 ksi and complete with accessories recommended by Manufacturer for proper installation.
      b. Fastening Devices: Galvanized steel screws.
   2. Finishes:
      a. Face coating polyvinyledene Fluoride (PVF_2) Resin-base finish (Kynar 500 or Hylar 5000) for coil coating components containing 70 percent minimum PVF_2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
      b. Reverse side coating thermo-cured system consisting of corrosion inhibiting epoxy primer applied over properly pre-treated metal.
      c. Color as selected by Architect from Manufacturer's standard colors.
   3. Type One Acceptable Manufacturers:
      a. AEP / Span, Dallas, TX www.aep-span.com.
      b. ATAS Aluminum Products, Allentown, PA www.atas.com
      c. Copper Sales Inc, Minneapolis, MN www.unaclad.com.
      d. Englert Inc, Perth Amboy, NJ www.englertinc.com.
      e. Fabral, Lancaster, PA www.fabral.com.
      f. Integris Metals, Minneapolis, MN www.integrismetals.com.
      g. Metal Sales Manufacturing Corp, Sellersburg, IN www.mtlsales.com.

h. Petersen Aluminum Corp, Elk Grove, IL www.pac-clad.com
i. VicWest, Goodlettsville, TN and Oakville, ON www.vicwest.com
j. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 FABRICATION

A. Facia may either be shop-fabricated using metal from a specified manufacturer, or a factory-fabricated standard system from a specified manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conceal fasteners except where details might require a minimum number to be exposed. Paint heads of exposed fasteners to match background.

B. Install with slip joints at each end. Screw to substrate through pre-drilled, over-size holes.

C. Isolate from dissimilar metals not part of facia system to prevent electrolytic action.

D. Repair buckling or bowing due to improper installation at no cost to Owner.

END OF SECTION

SECTION 07 7226

RIDGE VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Ridge vents.

B. Related Sections:
   1. Section 07 3113: Installation.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM A 653-002a, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.'
   2. ASTM A 792-03, 'Standard Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.'

PART 2 - PRODUCTS

2.1 FABRICATION

A. Type One Acceptable Fabricators:
   1. Keller & Assoc, Woods Cross, UT (801) 292-3613.
   2. MBCI, Salt Lake City, UT (801) 530-4975.
   3. Smart Enterprises, St George, UT (800) 658-5368 or (435) 628-1843.
   4. Southam & Associates, Pleasant Grove, UT (800) 838-5816 or (801) 796-1600 www.southamandassociates.com.
   5. Tricon Inc, Orem, UT (888) 565-9455 or (801) 765-9455.
   6. Warburton's Inc, Pleasant Grove, UT (801) 785-9500 www.warburtonsinc.com.
   7. Western Metal Products L.C., Woods Cross, UT (888) 298-3454 or (801) 298-5880.
   8. Other shop fabricated or manufactured product approved by Architect before bidding. See Section 01 6200.

B. Fabricated of 24 ga 0.635 mm minimum, hot-dipped galvanized to meet requirements of ASTM A 653, 1.25 oz/sq ft or galvalume meeting requirements of ASTM A 792 AZ50, 50 ksi or 0.032 inch 0.813 mm thick aluminum minimum, with edges returned or hemmed. Provide one inch high minimum hemmed baffle at downslope edge of skirt.

C. Design to include two-inch thick minimum polyethylene vent core providing 20 sq in NFVA minimum.
   1. Category Four Approved Products:
      a. Two layers V-600T by Cor-A-Vent www.cor-a-vent.com
      b. Two layers High Profile Rigid Vent PLUS 62406 TV-400 by Trimline www.trimline-products.com

D. Skirts and ridge cap connected through vent core with painted 1/4 by 1-1/2 inch 6 mm by 38 mm Type A corrosion resistant screws with neoprene washers 8 inches 200 mm on center each skirt.

E. Accessories: End plugs, splice plates, seal tape, straps, fasteners, and other accessories necessary for proper installation.

2.2 FINISHES

A. Exposed Side:
   1. Polyvinyledene Fluoride (PV_2) Resin-base finish (Kynar 500 or Hylar 5000) for coil coating components containing 70 percent minimum PVF_2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
   2. Color : Green to match roof metal.

B. Reverse Side: Coating shall pass requirements of paragraphs 1.1 through 1.4 of Test Method No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Manufacturer's installation instructions as approved by Architect and as follows:
   1. Install assembled ridge vent over shingles in bed of asphalt plastic cement with painted 1/4 inch by one inch 6 mm by 25 mm Type 'A' corrosion resistant screws with neoprene washers 8 inches 200 mm on center each side of vent.
   2. Join ridge vent units with screws, neoprene washers, splice plates, and tape sealant.

END OF SECTION

SECTION 07 9213

ELASTOMERIC JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants not specified to be furnished and installed under other Sections.
   2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

B. Related Sections:
   1. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Handle to prevent inclusion of foreign matter, damage by water, or breakage.

B. Deliver and keep in original containers until ready for use.

C. Do not use damaged or deteriorated materials.

D. Store in a cool place, but never under 40 deg F 4 deg C.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sealants:
   1. Sealants provided shall meet Manufacturer's shelf-life requirements.
   2. Exterior Building Elements:
      a. Joints and cracks around windows.
      b. Aluminum entrance perimeters and thresholds.
      c. Door frames.
      d. Louvers.
      e. Wall penetrations.
      f. Connections.
      g. Other joints necessary to seal off building from outside air and moisture.
      h. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
         1) Dow Corning:
            a) Primer: 1200.
            b) Sealant: 791.
         2) General Electric:
            a) Primer: SS4044.
            b) Sealant: Silpruf SCS 2000.
         3) Tremco:
            a) Primer:
               (1) Metal: No. 20.

(2) Other: No. 23.
b) Sealant: Spectrum 1.

3. Exterior Sheet Metal And Miscellaneous:
   a. Penetrations in soffits and fascias.
   b. Roof vents and flues.
   c. Flashings.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      1) 791 or 790 by Dow Corning.
      2) Sikaflex 15LM by Sika Corp.
      3) Tremsil 600 by Tremco.
4. Exterior Concrete:
   a. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      1) Joints between building foundations and exterior site concrete and in all expansion joints.
         a) Dow Corning:
            (1) Primer: 1200.
            (2) Sealant: 790.
         b) General Electric:
            (1) Primer: SS4044.
            (2) Sealant: Silpruf SCS 2000.
      2) Expansion joints in retaining walls:
         a) Dow Corning:
            (1) Primer: 1200.
            (2) Sealant: 790.
         b) General Electric:
            (1) Primer: SS4044.
            (2) Sealant: Silpruf SCS 2000.
5. Interior:
   a. Inside jambs and heads of exterior door frames.
   b. Inside perimeters of windows.
   c. Miscellaneous gaps between substrates.
   d. Category Four Approved Product. See Section 01 6200 for definitions of Categories.
      1) Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
      2) Acrylseal by General Electric.
      3) Tremsil 200 by Tremco.
6. Interior At Exposed Masonry Walls:
   a. Both sides of interior door frames.
   b. Category Four Approved Product. See Section 01 6200 for definitions of Categories.
      1) Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
      2) Acrylseal by General Electric.
      3) Tremsil 200 by Tremco.
7. Interior Joints Formed By:
   a. Countertops and backsplash to wall.
   b. Sinks and lavatories to countertops.
   c. Termination joints in showers.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      1) Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
      2) Acrylseal by General Electric.
      3) Tremsil 200 by Tremco.
8. Color: As selected by Architect from Manufacturer's standard colors.

B. Backing: Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.

2.2 MANUFACTURERS

A. Contact Information:
   1. Dow Corning Corp, Midland, MI www.dowcorning.com.

2. G E Silicone Products, Waterford, NY www.gesealants.com .
3. Sika Corporation, Lyndhurst, NJ www.sika.com .
4. Tremco, Cleveland, OH www.tremcosealants.com .

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces shall be clean, dry, and free of dust, oil, grease, dew, or frost.

B. Apply primer, if required.

C. Joint Backing:
1. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch 10 mm deep.
2. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

3.2 APPLICATION

A. Apply sealant with hand-calking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.

B. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.

C. Depth of sealant bite shall be 1/4 inch 6 mm minimum and 1/2 inch 13 mm maximum, but never more than one half or less than one fourth joint width.

D. Do not apply calking at temperatures below 40 deg F 4 deg C.

E. Calk gaps between painted or coated substrates and unfinished or pre-finished substrates. Calk gaps larger than 3/16 inch 9 mm between painted or coated substrates.

3.3 CLEANING

A. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

END OF SECTION

B L A N K P A G E

DIVISION 08: OPENINGS

08 0000 OPENINGS

08 0601 HARDWARE GROUP AND KEYING SCHEDULES

08 1000 DOORS AND FRAMES

08 1213 HOLLOW METAL FRAMES
08 1313 HOLLOW METAL DOORS

08 3000 SPECIALTY DOORS AND FRAMES

08 3110 ACCESS DOORS AND PANELS

08 5000 WINDOWS

08 5113 ALUMINUM PROJECTEDWINDOWS

08 6000 ROOF WINDOWS AND SKYLIGHTS

08 6200 TUBULAR SKYLIGHTS

08 7000 HARDWARE

08 7101 COMMON FINISH HARDWARE REQUIREMENTS
08 7102 HANGING DEVICES
08 7103 SECURING DEVICES
08 7104 OPERATING TRIM
08 7106 CLOSING DEVICES
08 7107 PROTECTIVE PLATES AND TRIM
08 7108 STOPS AND HOLDERS
08 7109 ACCESSORIES

08 8000 GLAZING

08 8100 GLASS GLAZING

END OF TABLE OF CONTENTS

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SECTION 08 0601

HARDWARE GROUP AND KEYING SCHEDULES

PART 1 - HARDWARE GROUP SCHEDULE for FINISH HARDWARE

1.1 DEFINITIONS

A. Builders Hardware Manufacturer's Association (BHMA) Hardware Functions:
1. F-75 Passage Latch: Latch bolt operated by knob / lever from either side at all times.
2. F-76 Privacy Lock: Latch bolt operated by knob / lever from either side. Outside knob / lever locked by push button inside and unlocked by emergency key from outside or rotating knob / lever from inside.
3. F-81 Office Door Lock: Dead locking latch bolt operated by knob / lever from either side, except when outside knob / lever is locked by turn button in inside knob/lever. When outside knob / lever is locked, latch bolt is operated by key in outside knob/lever or by rotating inside knob / lever. Turn button must be manually rotated to unlock outside knob / lever.
4. F-84 Classroom Deadlock: Dead locking latch bolt operated by knob / lever from either side, except when outside knob / lever is locked, latch bolt is operated by key in outside knob / lever or by rotating inside knob / lever.
5. F-86 Utility Space Door Lock: Dead locking latch bolt operated by key in outside knob / lever or by rotating inside knob / lever. Outside knob / lever is always fixed.
6. F-91 Latch And Deadlocks: Dead locking latch bolt operated by key from both sides.
7. E-2142 Deadbolt: Dead bolt operated by key from either side. Bolt automatically dead locks when fully thrown.
8. E-2152 Deadbolt: Dead bolt operated by key from outside and turn button from inside. Bolt automatically dead locks when fully thrown.

1.2 SINGLE EXTERIOR DOORS:

Group 1 Doors 05, 06, 07, 08, 09	
a. 3 each	Hinges.
b. One each	Deadbolt, Function E-2152.
c. One pair	Pull. Each Side
d. One each	Stop and Holder
e. One each	Threshold.
f. One set	Weatherstopping.
g. One each	Kickplate on Interior
Group 3 Doors 01, 03	
a. 3 each	Hinges.
b. One each	Latchset F75
c. One each	Closer.
d. One each	Wall Stop.
e. One each	Threshold.
f. One set	Weatherstopping.
g. One each	Deadbolt E2142
h. One each	Kickplate Exterior Side
Group 3 Doors 04, 10	
a. 3 each	Hinges.
b. One each	Lockset Function F-91.
c. One each	Closer.
d. One each	Wall Stop.
e. One each	Threshold.
f. One set	Weatherstopping.

g. One each	Kickplate Exterior Side

1.3 Keying

A. Re-key new cores after construction and key doors per State Parks direction.

END OF SECTION

SECTION 08 1213

HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Hollow metal frames.

B. Related Sections:
   1. Section 06 2024: Installation.

1.2 REFERENCES

A. Steel Door Institute / American National Standards Institute:
   1. SDI / ANSI A250.11-2002, 'Recommended Erection Instructions for Steel Frames.'

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Frames:
   1. Cold rolled furniture steel.
      a. Exterior Frames: 14 ga. 2 mm.
   2. Finish:
      a. Use one of following systems:
         1) Prime surfaces with rust inhibiting primer.
   3. Anchors: 16 US ga 1.6 mm minimum meeting UL or other code acceptable requirements for door rating involved.

2.2 MANUFACTURERS

A. Category One Approved Manufacturers. See Section 01 6200 for definitions of Categories.
   1. Any current member of Steel Door Institute.

2.3 FABRICATION

A. General Requirements:
   1. Frames shall be welded units. Provide temporary spreader on each welded frame.
   2. Provide Manufacturer's gauge label for each item.
   3. Make breaks, arrises, and angles uniform, straight, and true. Accurately fit corners.

B. Provide mortar guards at strikes and hinges.

C. Anchors:

1. Provide three jamb anchors minimum for each jamb. On hinge side, install one anchor at each hinge location. On strike side, install one anchor at strike level and anchors at same level as top and bottom hinges. Tack weld anchors on frames intended for installation in framed walls.
2. Frames installed before walls are constructed shall be provided with extended base anchors in addition to other specified anchors.
3. Anchor types and configurations shall meet wall conditions.

PART 3 - EXECUTION

3.1 SUPPLIERS

A. Suppliers. See Section 01 6200 for definitions of Categories.
   1. Architectural Building Supply, Salt Lake City, UT Russ Farley, Phone (800) 574-4369 FAX 801-484-6817, e-mail russf@absdoors.com.
   2. Beacon Metals Inc, Salt Lake City, UT Jared Butler, Phone (888) 823-2206, FAX 801-485-764, e-mail jared@beacon-metals.com

END OF SECTION

SECTION 08 1313

HOLLOW METAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Hollow metal doors.

B. Related Sections:
   1. Section 06 2024: Door installation.

1.2 REFERENCES

A. Steel Door Institute:
   1. SDI -100-91, 'Recommended Specifications, Standard Steel Doors And Frames.'

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Doors:
   1. Meet requirements of Steel Door Institute Bulletin SDI-100.
      a. Grade II for exterior doors.
      b. Model 1 Full Flush or Model 2 Seamless designs at Manufacturer's option.
      c. Type F, G, or L as required.
      d. Finish:
         1) Exterior doors galvanized and primed.
   2. Insulation: Insulate doors at exterior of main building sufficient to provide U-value of 0.10 maximum.

2.2 MANUFACTURERS

A. Category One Approved Manufacturers. See Section 01 6200 for definitions of Categories.
   1. Any current member of Steel Door Institute.

2.3 FABRICATION

A. General:
   1. Mortise and reinforce doors for hinges and locks.
   2. Reinforce doors for closers and other surface applied hardware.
   3. Drill and tap on job.
   4. Seams along vertical edges of door need not be filled.
   5. Do not extend hinge cut out full width of door unless fill strip is inserted, weld filled, and ground smooth so no seam appears on back face plate.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Label each door as conforming to above required standards.

PART 3 - EXECUTION

3.1 SUPPLIERS

A. Suppliers. See Section 01 6200 for definitions of Categories.
   1. Architectural Building Supply, Salt Lake City, UT Russ Farley, Phone (800) 574-4369 FAX 801-484-6817, e-mail russf@absdoors.com.
   2. Beacon Metals Inc, Salt Lake City, UT Jared Butler, Phone (888) 823-2206, FAX 801-485-764, e-mail jared@beacon-metals.com

END OF SECTION

SECTION 08 3110

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Manufactured access doors.

B. Related Sections:
   1. Section 06 2001: Installation.
   2. Section 06 2001: Field fabricated access doors.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Standard Ceiling Access Doors:
   1. Manually operated with key operated lock, single cam handle, and continuous piano hinge hardware.
   2. Factory powder-coated prime finish.
   3. Non-Fire-Rated Quality Standards:
      a. Acoustical Tile: DSC-210 by Karp.
      b. Plaster: DSC-210 PL by Karp.
      c. Drywall: KDW or Sesame (KSTDW or KSTE) by Karp.
      d. Masonry: DSC-214M by Karp.
   4. Type One Acceptable Manufacturers:
      a. Dur-Red Products, Cudahy, CA (323) 771-9000. www.dur-red.com
      b. Elmdor Stoneman, City of Industry, CA www.elmdorstoneman.com.
      c. Jensen Industries, Los Angeles, CA www.jensen-ind.com.
      d. Karp Associates Inc, Maspeth, NY www.karpinc.com.
      e. Larsen's Manufacturing Co, Minneapolis, MN www.larsensmfg.com
      f. Milcor Limited Partnership, Holland, OH www.milcorinc.com.
      g. Nystrom Inc, Minneapolis, MN www.nystrom.com
      h. Williams Brothers Corporation of America, Reno, NV www.wbdoors.com
      i. Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 08 5113

ALUMINUM PROJECTED WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install window units as described in Contract Documents.

B. Related Sections:
   1. Section 07 9213: Quality of sealant and backer rod.
   2. Section 08 8100: Quality of glass glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association / American National Standards Institute:
   1. AAMA / ANSI / NAFS 1-2000, Voluntary Performance Specification for Windows, Skylights and Glass Doors.'

B. American Architectural Manufacturers Association:
   1. AAMA 1503.1-88, 'Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.'

1.3 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Comply with minimum test requirements of ANSI / AAMA 101 for classification of specified window in following:
      a. Air infiltration.
      b. Water Resistance.
      c. Uniform structural load.
   2. ANSI / AAMA 101 classification DH-C45 minimum for hung windows, tested at 4 feet wide by 7 feet high minimum.

B. Performance Requirements:
   1. Meet following thermal performance:
      a. Condensation Resistance Factor (CRF) of 48 minimum when tested in accordance with AAMA 1503.
      b. Thermal Transmittance of 0.65 maximum when tested in accordance with AAMA 1503.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature or cut sheet.
   2. Literature on glazing.
   3. Color and finish selection.

B. Quality Assurance / Control:
   1. Manufacturer's published installation instructions for windows, flashing, and sealants.

1.5 WARRANTY

A. Provide written non-prorated manufacturer's warranty including:
   1. 10 years for seal failure.
   2. 2 years for failure of operating hardware.
   3. 2 years on stress cracks related to fabrication or installation problems.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Windows:
   1. Factory glazed.
   2. Weatherstripped.
   3. Thermally broken system with poured-in-place and de-bridged structural thermal break.
   4. Non-flanged for installation in masonry buildings. Installation method shall not require drilling into frame.
   5. Finish And Color:
      a. Meet requirements of AAMA 603.8 for baked-on organic coating.
      b. Category Four Approved Color. See Section 01 6200 for definitions of Categories.
         1) Dark Bronzed.
   6. Glazing Characteristics:
      a. Obscure interior pane with pattern on surface 3 and Clear exterior pane with Low E treatment on surface 2.
   7. Glazing Beads: Manufacturer's standard.
   8. Screens: Extruded aluminum frames with mitered corners and 18 x 14 mesh with 0.013 inch diameter aluminum wire or fiberglass.
   9. Approved Product.
      a. TR-5400 by Traco, Cranberry Township, PA www.traco.com.
      b. TR-240 by Traco, Cranberry Township, PA www.traco.com.
      c. Or equal.

2.2 ACCESSORIES

A. Flashing:
   1. Self-adhesive rubberized asphalt with protective sheet.
   2. Type Two Acceptable Products:
      a. Flexwrap by duPont Tyvek, Wilmington, DE www.tyvek.com.
      b. Eternabond, Hawthorn Woods, IL www.eternabond.com.
      c. FortiFlash 20 mil by Fortifiber, Reno, NV www.fortifiber.com.
      d. Vycor Self-Adhered Flashing by Grace Construction Products, Cambridge, MA www.graceconstruction.com.
      e. Optiflash B-20 by Ludlow Coated Products, Doswell, VA www.ludlowcp.com.
      f. BR20XL or Ice & Water Guard Window Sealing Tapes by Protecto Wrap, Denver, CO www.protectowrap.com.
      g. Rufco-Shield Window & Door Flashing by Raven Industries, Sioux Falls, SD www.ravenind.com.
      h. Polyken butyl adhesive flashing tape by Tyco Adhesives, Norwood, MA www.tycoadhesives.com.
      i. Equal as approved by Architect before installation. See Section 01 6200.

B. Anchoring Devices:
   1. Aluminum or stainless steel.
   2. Other corrosion-resistant or insulated anchors as specifically approved by Architect in writing before use.

2.3 SOURCE QUALITY CONTROL

A. When delivered to Project site, windows shall bear permanent label stating model of window and Manufacturer's name, or AAMA label.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Integrate flashing and sealants as required to provide weather tight installation and comply with Manufacturer's instructions.

B. Set window frame plumb, level, and in alignment. Secure window properly in opening.

C. Apply specified sealant between window frame and building wall at building interior. Trim off excess sealant.

D. Avoid direct contact between aluminum and adjacent steel work by insulating with materials equal to 3M's EC 1202 tape if materials are in pressure contact, or with bituminous paint if pressure between surfaces cannot be maintained.

3.2 FIELD QUALITY CONTROL

A. Inspections:
   1. Notify Architect when windows are to be delivered to Project site to allow opportunity for Architect's inspection before installation.

3.3 ADJUSTING

A. After windows are in place, installer shall adjust hardware and ventilators to operate smoothly and be weather tight when closed.

3.4 CLEANING

A. After installation, clean interior and exterior metal surfaces of windows and accessories of mortar, plaster, paint, and other contaminants. Maintain protection and provide final cleaning.

END OF SECTION

B L A N K P A G E

08 6200
TUBULAR SKYLIGHTS

PART 1 GENERAL

1.1_ WORK INCLUDED

A. Provide all labor, materials, tools, and services to install tubular skylight system and related components as shown on drawings and specified herein.

1.2 REFERENCES

A. ASTM B209- Specification for Aluminum and Aluminum Alloy Sheet and Plate.

B. ASTM D635- Test Method for Rate of Burning and/or Extent and Time of Burning of Self- Supporting Plastics in a Horizontal Position.

C. ASTM D1929- Test Method for Ignition Properties of Plastics.

D. ASTM D2843- Test Method for Density of Smoke from the Burning of Decomposition of Plastics.

E. ASTM E330- Structural Performance of Exterior Windows, Curtain Walls and Doors.

F. ASTM E331- Test Method for Water Penetration of Exterior Windows, Curtain walls and Doors by Static Air Pressure Difference.

G. UL 181- Factory Made Air Ducts and Connectors.

1.3 QUALITY ASSURANCE

A. General

1. Provide certified independent laboratory test reports in full accord with Section 1.03, Paragraph C.

2. Provide tubular skylight system which maintains U.L. (Underwriters Laboratories) listing.

3. Provide tubular skylight system which has been evaluated and approved by ICBO and maintains a current Evaluation Report.

B. Test Units

1. Perform all tests unless otherwise noted per reference standards on unit size(s) which will be incorporated in the project.

C. Test Procedures

1. Air Infiltration Test

a. Air Infiltration maximum 0.10 cfm per foot of crack length at 6.24 psf pressure differential when tested in accordance with ASTM E283.

2. Water Resistance Test

a. No uncontrolled water leakage at 6.00 psf pressure differential with water rate of 5 gallons/hours/s.f. when tested in accordance with ASTM E331.

3. Uniform Load Deflection Test

a. No breakage, permanent damage to fasteners, hardware parts, or damage to make tubular skylight inoperable at both a positive and a negative load of 146.8 psf. All tests shall be in accordance with ASTM E330.
Reference note: Design wind pressures are obtained from ANSI A58.1, local building codes or specified boundary layer wind tunnel data.

4. Uniform Load Structural Test

a. Unit to be tested at 3x positive wind pressure and 2x negative wind pressure, acting normal to plane of roof in accordance with ASTM E330.

b. No breakage, permanent damage to fasteners, hardware parts, or damage to make tubular skylight inoperable or permanent deflection of any section in excess of 0.2 % of its span.

1.4 SUBMITTALS

A. Shop Drawings/Samples
1. Shop drawings complete and full scale (where practical) showing construction of all components, dimensions and details.
2. Samples of product as requested by the Architect.

B. Test Reports/Calculations

1. Certified independent laboratory test reports verifying compliance with all test requirements of Section 1.03.

1.5 GUARANTEE

A. Tubular Skylight and Related Materials

1. Ten-year guarantee on materials and workmanship from the Manufacturer. One-year guarantee from the installer for materials and labor.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brighten-Up Series - 290 DS 14” diameter model- as manufactured by:

Solatube International, Inc
2210 Oak Ridge Way
Vista, CA 92083-8341
(760) 597-4400
is approved for use and is the design standard.

B. Other manufacturers may be acceptable prior to bidding.

2.2 MATERIALS

A. Roof Dome

1. Injection molded polycarbonate classified as CC1 material. Thickness shall not be less than 0.125”. Visible light transmission shall be 92 percent or greater. Acrylic dome shall be approved in no-UL applications provided it meets characteristics of Duradome 10 (i.e. DR-101 blend). Roof dome shall contain Raybender Technology, a series of concentric, light refracting etched lines a minimum of 2” high to improve light input when sun is low on horizon.

B. Ceiling Diffuser:

1. Injection molded, acrylic plastic classified as CC2 Plexiglas. Thickness shall not be less than 0.087”. Provide special prismatic design to maximize light output.

C. Roof Flashing:

1. Select flashing from manufacturer's standard pitched options to suit job site conditions.

D. Main Tube:

1. Fabricate from Aluminum sheet meeting the requirements of ASTM B209, alloy and temper as required by the manufacturer to suit forming operations and finish requirements.

2. Finish- Provide exposed aluminum surface with high polished specular finish meeting AAMA designation M21C31A31. Reflective surface to be Spectralight 2000 or equal. Specular reflectance to be 92 percent and total reflectance to be 95 percent.

E. Accessories:

1. Ceiling Ring to be 30 percent talc filled polypropylene or high impact ABS.

2. Sealant- Polyeurathane or copolymer based elastomeric sealant- use type provided or recommended by the manufacturer.

3. Seals:
   a. Weather seal- Medium density pile weatherstripping and light density polyvinyl chloride foam tape or UV resistant EPDM rubber.
   b. Ceiling Diffuser seal- Closed cell polyethylene foam, 3 pounds per cubic foot, and white polyvinyl chloride seal, butt joint welded or EPDM rubber.

4. Fasteners shall be same as metals being fastened or non-magnetic stainless steel or other non-corrosive metal as recommended by the manufacturer.

2.3 FABRICATION

A. General

1. Finish, fabricate and shop prepare all assemblies under responsibility of one manufacturer.

2. Fabricate to allow for thermal movement of materials when subject to a temperature differential from- 30 degrees F to +180 degrees F.

3. Provision shall be made to insure that water will not accumulate and remain in contact within system components.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install tubular skylights in accordance with manufacturer's printed installation instructions.

B. Installer to be factory trained and/or certified by the manufacturer prior to commencement of installation.

C. After installation of first unit-conduct field check to determine compliance with specified requirements. Water test in presence of Owners Representative or Architect or Contractor Representative. Correct any deficiencies prior to commencing with subsequent units.

End of Section

B L A N K P A G E

SECTION 08 7101

COMMON FINISH HARDWARE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. General requirements for finish hardware related to hollow metal doors.

B. Related Sections:
   1. Section 06 2024: Installation.
   2. Section 06 4124: Architectural woodwork hardware.
   3. Section 08 0601: Hardware Group Schedules.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's cut sheets.
   2. Two copies of Manufacturer’s installation, adjustment, and maintenance instructions for each piece of hardware. Include one set in Operations And Maintenance Manual and send one set with hardware when delivered.
   3. Copy of hardware schedule.
   4. Written copy of keying system explanation. Keying information shall include high security keyway supplier's name, address, and phone number.

B. Shop Drawings: Submit hardware schedule indicating hardware to be supplied. Schedule shall indicate details such as proper type of strikeplates, spindle lengths, hand, backset, and bevel of locks, hand and degree opening of closer, length of kickplates, length of rods and flushbolts, type of door stop, and other necessary information necessary to determine exact hardware requirements.

C. Quality Assurance / Control: Certificate or letter signed by hardware supplier and by Contractor stating that hardware provided is same as that specified in Contract Documents.

D. Closeout: Submit keying plan and bitting schedule as record documents.

1.3 QUALITY ASSURANCE

A. Suppliers bidding this work shall have two years minimum experience in providing, detailing, scheduling, and installing builders hardware and shall employ at least one full time DHI Architectural Hardware Consultant (AHC).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Neatly and securely package hardware items by hardware group and identify for individual door with specified group number and set number used on Supplier's hardware schedule. Include fasteners and accessories necessary for installation and operation of finish hardware in same package.

PART 2 - PRODUCTS

2.1 FINISHES

A. Finishes for steel, brass, or bronze hardware items shall be US26D, Chromium plated, satin, except flat goods which may be US32D, stainless steel, satin. Materials other than steel, brass, or bronze shall be finished to match the appearance of US26D / 32D.

2.2 FASTENERS

A. Fasteners shall be of suitable types, sizes and quantities to properly secure hardware. Fasteners shall be of same material and finish as hardware unless otherwise specified. Fasteners exposed to weather shall be non-ferrous or corrosion resisting steel.

PART 3 - EXECUTION

3.1 SUPPLIERS

A. Approved Suppliers. See Section 01 6200 for definitions of Categories.
   1. Architectural Building Supply, Salt Lake City, UT Russ Farley, Phone (800) 574-4369, FAX 801-484-6817, e-mail russf@absdoors.com.
   2. Beacon Metals Inc, Salt Lake City, UT Jared Butler, Phone (888) 823-2206, FAX 801-485-764, e-mail jared@beacon-metals.com.

3.2 PREPARATION

A. Before ordering materials, examine documents to be assured that material to be ordered is appropriate for substrate to which it is to be secured and will function as intended.

END OF SECTION

SECTION 08 7102

HANGING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Hinges for hollow metal doors.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Hinges:
   1. Sizes:
      a. 1-3/4 inch 45 mm doors and fire-rated doors in metal frames:
         1) Standard: 4-1/2 inches by 4-1/2 inches 113 mm by 113 mm.
         2) Wide Throw: 4-1/2 inches 113 mm by width required.

   2. Use non-removable pins on exterior opening doors.
   3. Hinges on exterior doors shall be solid brass, plated to achieve specified finish.
   4. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. Exterior:
         1) Hager: BB 1191.
         2) Ives: 5BBI.
         3) McKinney: TA 2314.
         4) PBB: BB21.
         5) Stanley: FBB 191.

2.2 MANUFACTURERS

A. Approved Manufacturers:
   1. Hager Companies, St Louis, MO www.hagerhinge.com.
   2. Ives, New Haven, CT www.iveshardware.com.
   3. McKinney, Scranton, PA www.mckinneyhinge.com.
   4. PBB, Ontario, CA www.pbbinc.com.
   5. Stanley, New Britain, CT www.stanleyworks.com.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 08 7103

SECURING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Items for hollow metal doors:
      a. Locksets and latchsets.
      b. Deadbolts.
      c. Cylinders.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Standard Key Delivery:
   1. Include change keys with hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. General:
   1. Backsets shall be 2-3/4 inches 70 mm.
   2. Furnish lead shields where required.

B. Locksets And Latchsets:
   1. Lever Operated:
      a. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
         1) CL3300 Series by Corbin Russwin.
         2) 7 Series by Sargent.
         3) AL Series by Schlage.

C. Deadbolts:
   1. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. Match manufacturer of locksets.

D. Standard Cylinders:
   1. Category Four Approved Products.
      a. Match Manufacturer of locksets.

2.2 MANUFACTURERS

A. Contact Information:
   1. Corbin Russwin, Berlin, CT www.yalesecurity.com.
   2. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.

3. Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
4. Ives, New Haven, CT www.iveshardware.com.
5. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com.
6. Precision Hardware, Romulus, MI www.precisionhardware.com.
7. Rockwood, Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
8. Sargent, New Haven, CT www.sargentlock.com.
9. Schlage, Colorado Springs, CO www.schlage.com.
10. Von Duprin, Indianapolis, IN www.vonduprin.com.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 7104

OPERATING TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Exterior push / pulls.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Standard Door Push / Pulls:
   1. Size: 15 by 3-1/2 inches 375 mm by 88 mm.
   2. Type Two Acceptable Products:
      a. PS3515, PL3515 / 80301 by Glynn-Johnson.
      b. 39E, 30S by Hager.
      c. 70B, 105x70B by Rockwood.

2.2 MANUFACTURERS

A. Contact Information:
   1. Forms + Surfaces, Carpenteria, CA www.forms-surfaces.com.
   2. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
   3. Hager, St Louis, MO www.hagerhinge.com
   4. Ives, Wallingford, CT www.iveshardware.com.
   5. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com.
   6. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
   7. Trimco / BBW, Los Angeles, CA www.trimcobbw.com.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 08 7106

CLOSING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Closers for hollow metal doors.

B. Related Sections
   1. Section 08 7101: Common Hardware Requirements:

1.2 WARRANTY

A. Provide Manufacturer's standard warranty, 5 years minimum.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Surface-Mounted Overhead Door Closers:
   1. Closers provided under this Section shall be from same Manufacturer.
   2. Provide parallel arms on closers unless door position in relation to adjacent wall requires otherwise. Provide covers.
   3. Closers shall allow for 180 degree opening and not be used as a stop.
   4. Closers shall have following features:
      a. Adjustable sweep speed.
      b. Adjustable backcheck.
      c. Non-handed, non-sized.
      d. Delayed action closing where noted on Door Schedule.
   5. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. 7900 Series by Dorma Architectural Hardware, Reamstown, PA www.dorma.com/usa.
      b. 1461 Series by LCN Closers, Princeton, IL www.lcnclosers.com.
      c. 8501 Series by Norton Door Controls, Charlotte, NC www.nortondoorcontrols.com.
      d. 1431 Series by Sargent, New Haven, CT www.sargentlock.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount closers on stop side of door wherever conditions permit.

B. Through-bolt hardware-to-door connections.

3.2 ADJUSTING

A. Adjust closers to provide maximum opening force as required by governing code authority and proper backcheck and sweep speed.

END OF SECTION

SECTION 08 7107

PROTECTIVE PLATES AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Kick plates.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Protective Plates:
   1. Material: 0.050 inch 1.3 mm thick Stainless Steel.
   2. Sizes:
      a. Kick Plates: 10 inches 250 mm high by width of door less 3/4 inch 19 mm on each side.
   3. Type Two Acceptable Manufacturers:
      a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b. Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
      c. Ives, Wallingford, CT www.iveshardware.com.
      d. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      e. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 08 7108

STOPS AND HOLDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Door stops.
   2. Door stops and holders.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Stops:
   1. Use wall type stops unless indicated otherwise on Door Schedule.
   2. Provide model appropriate for substrate. Wall stops may be either cast or wrought.
   3. Type Two Acceptable Products:

		Interior Wall	Exterior Wall	Floor Mount	Overhead.
a.					
b.	Hager	236W	255W	243F	- - -
c.	Ives	WS407CCV	WS447	FS438	- - -
d.	Rockwood	409	474 / 475	440 / 441	- - -
e.	Corbin Russwin	- - -	- - -	- - -	DH5203 Series
f.	Glynn Johnson	- - -	- - -	- - -	GJ 90S
g.	Sargent	- - -	- - -	- - -	590S Series

      h. Equal as approved by Architect before Installation. See Section 01 6200.

B. Door Stops And Holders:
   1. Type Two Acceptable Products:
      a. Hager: 268F, 268S or 256S, 256W.
      b. Ives: WS444, WS449, FS446, FS450.
      c. Rockwood: 472, 473, 476, 477.
      d. Equal as approved by Architect before Installation. See Section 01 6200.

2.2 MANUFACTURERS

A. Contact Information:
   1. Corbin Russwin, Berlin, CT www.corbinrusswin.com.
   2. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
   3. Hager, St Louis, MO www.hagerhinge.com.
   4. Ives, Wallingford, CT www.iveshardware.com.
   5. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
   6. Sargent, New Haven, CT (800) 906-6606 or (203) 562-2151 www.sargentlock.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: When using overhead stops, coordinate installation with door closer and other door hardware.

END OF SECTION

SECTION 08 7109

ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Metal thresholds where required for hollow metal doors.
   2. Weatherstripping for exterior hollow metal doors.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements and VMR Suppliers.
   2. Section 09 3005: Stone thresholds.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Thresholds:
   1. Type One Acceptable Products:
      a. Out swinging Exterior Doors, Approved Products:
         1) 560SV by Hager.
         2) 891V by NGP.
         3) 185AV by Pemko.
      b. In swinging Exterior Doors, Approved Products:
         1) 602A with 770S Rain Drip and 713SA Surface Hook by Hager.
         2) 345 with 15D Rain Drip and 81A Surface Hook by NGP.
         3) 110A with 345 Rain Drip and 66A Surface Hook by Pemko.
      c. Equals as approved by Architect before bidding. See Section 01 6200.

B. Weatherstripping:
   1. Type One Acceptable Products:
      a. Perimeter:
         1) 800S by Hager.
         2) A625A by NGP.
         3) 35041CP by Pemko.
      b. Bottom:
         1) Equal by Hager.
         2) 198NA by NGP.
         3) Equal by Pemko.
      c. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 MANUFACTURERS

A. Contact Information:
   1. Hager, St Louis, MO www.hagerhinge.com.
   2. Ives, Wallingford, CT www.iveshardware.com.
   3. NGP - National Guard Products, Memphis, TN www.ngpinc.com.
   4. Pemko, Ventura, CA www.pemko.com.

5. Trimco / BBW, Los Angeles, CA www.trimcobbw.com.

PART 3 - EXECUTION

END OF SECTION

SECTION 08 8100

GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of glazing used in windows.

B. Related Sections:
   1. Section 08 5113 or 08 5313: Furnishing and installing of glazing in windows.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM C 1036-01, 'Standard Specification For Flat Glass.'
   2. ASTM C 1048-04, 'Standard Specification For Heat-Treated Flat Glass - Kind H, Kind FT Coated and Uncoated Glass.'
   3. ASTM E 774-97, 'Standard Specification for Sealed Insulating Glass Units.'

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Glazing shall meet applicable requirements of Federal Consumer Product Safety Standard 16CFR1201.

B. Manufacturer's Labels: Labels showing strength, grade, thickness, type, and quality are required on each piece of glass.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Exterior Window Glazing:
   1. Thickness: 1/8 inch 3 mm minimum, Double Strength.
   2. Glazing shall have following characteristics:
      a. Clear: ASTM C 1036, Type I, Class I, Quality q3, U valve of .35, solar heat gain coefficient .62, Low E.
      b. Pyrolytic Low E:
         1) Performance Standard: Energy Advantage Clear by LOF.
         2) Type One Acceptable Manufacturers:
            a) AFG
            b) LOF
            c) PPG
            d) Visteon.
            e) Other low E glazing system standard with window manufacturer that meets or exceeds performance characteristics of specified glazing is acceptable as approved by Architect before bidding. See Section 01 6200.
      c. Obscure: ASTM C 1036, Type II, Class I, Form 3, Quality q8, Pattern #62.

d. Glazing in windows shall be tempered meeting requirements of ASTM C 1048, Kind FT, Condition A, Type I, Class I, Quality q3.

2.2 MANUFACTURERS

A. Contact Information for Low E Glazing Manufacturers:
   1. AFG Industries, Kingsport, TN www.afg.com.
   2. Pilkington Libby-Owens-Ford - LOF, Toledo, OH www.pilkington.com.
   3. PPG Industries, Pittsburgh, PA www.ppgglass.com.
   4. Visteon, Allen Park, MI www.visteon.com/floatglass/

2.3 FABRICATION

A. Except where glass exceeds 66 inches 1 650 mm in width, cut clear glass so any wave will run horizontally when glazed.

B. Sealed, Insulating Glazing Units:
   1. Double pane, sealed insulating glass units meeting requirements of ASTM E 774, Class A. Install at exterior windows.
   2. Unit Thickness: 5/8 inch 16 mm minimum, one inch 25 mm maximum.
   3. Insulated obscure units shall consist of one pane of specified obscure glass and one pane of standard glass.
   4. Type Seal:
      a. Metal-to-glass bond and separated by 1/2 inch 13 mm dehydrated air space.
      b. Use non-hardening sealants.
   5. Category Four Approved Fabricators.
      a. Members of Sealed Insulating Glass Manufacturer's Association.

PART 3 - EXECUTION: Not Used

END OF SECTION

DIVISION 09: FINISHES

09 2000 PLASTER AND GYPSUM BOARD

09 2900 GYPSUM BOARD

09 3000 TILING

09 3005 TILE SETTING MATERIALS AND ACCESSORIES
09 3013 CERAMIC TILING

09 9000 PAINTS AND COATINGS

09 9125 INTERIOR PAINTED WOOD
09 9321 INTERIOR SEALED CONCRETE FLOORS

END OF TABLE OF CONTENTS

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SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install gypsum board as described in Contract Documents.
   2. Furnish and install acoustical sealants as described in Contract Documents.

B. Related Sections:
   1. Section 07 9219: Quality of acoustical sealants.
   2. Section 09 9413: Textured finishing

1.2 REFERENCES

A. Gypsum Association:
   1. GA-214-90: 'Recommended Specification: Levels of Gypsum Board Finish.'

B. American Society For Testing And Materials:
   1. ASTM C 36-03, 'Standard Specification for Gypsum Wallboard.'
   2. ASTM C 475-02, 'Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.'
   3. ASTM C 840-01, 'Standard Specification for Application and Finishing of Gypsum Board.'
   4. ASTM C 1396-04, 'Standard Specification for Gypsum Board.'

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name, applicable standard designation, and Manufacturer's name.

B. Store material under roof and keep dry. Stack gypsum board flat and protect from damage.

1.4 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Temperature shall be 50 deg F 10 deg C and 95 deg F 35 deg C maximum day and night during entire joint operation and until execution of Certificate of Substantial Completion.
   2. Provide ventilation to eliminate excessive moisture.
   3. Avoid hot air drafts that will cause too rapid drying.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Gypsum Board:
   1. Non-Fire-Rated Construction:

a. Class Two Quality Standard: Product meeting requirements of ASTM C 36, C 1396. Board installed in areas accessible to public shall have tapered edge to accommodate taping and face paper suitable for painting.

2.2 ACCESSORIES

A. Joint Compound:
1. Best grade or type recommended by Board Manufacturer and meeting requirements of ASTM C 475.
   a. Use Taping Compound for first coat to embed tape and accessories.
   b. Use Taping Compound or All-Purpose Compound for subsequent coats except final coat.
   c. Use Finishing Compound for final coat and for skim coat.
   d. Joint Reinforcing: Paper reinforcing tape acceptable to Board Manufacturer.

B. Primer / Surfacer Under Surfaces To Receive Texturing:
1. Type Two Acceptable Products:
   a. Sheetrock First Coat by USG.
   b. Prep Coat Plus by Hamilton Materials.
   c. ProForm Surfacer / Primer by National Gypsum.
   d. Level Coat by Magnum Products.
   e. Equal as approved by Architect before bidding. See Section 01 6200.

C. Fasteners:
1. Bugle head screws meeting requirements of ASTM C 1002.
   a. Types:
      1) Type W: For fastening gypsum board to wood members.
      2) Type S: For fastening gypsum board to steel framing and ceiling suspension members.
   b. Lengths:
      1) Of length to penetrate wood framing 5/8 inch 16 mm minimum.
      2) Of length to penetrate steel framing 3/8 inch 10 mm minimum.

2.3 MANUFACTURERS

A. Contact Information:
1. Beadex Drywall Accessories, Auburn, WA www.usg.com.
2. Chicago Metallic, Chicago, IL www.chicago-metallic.com.
3. Drywall Systems International, Bend, OR www.no-coat.com.
4. Georgia Pacific, Atlanta, GA (800) 225-6119 or (404) 652-4000. www.gp.com.
5. Hamilton Materials Inc, Orange, CA www.hamiltonmaterials.com.
6. Magnum Products, Lenaxa, KS www.levelcoat.com.
7. National Gypsum, Charlotte, NC www.national-gypsum.com.
8. United States Gypsum Co, Chicago, IL www.usg.com.
9. Wm. Zinsser & Co, Somerset, NJ www.zinsser.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: Coordinate with Division 06 for location of backblocking for edges and ends of gypsum board and for blocking required for installation of equipment and building specialties. Do not install gypsum board until required blocking is in place.

B. General: Install and finish as recommended in ASTM C 840 unless specified otherwise in this Section.

C. Interior Gypsum Board:

1. General:
    a. Install so trim and reinforcing tape are fully backed by gypsum board. No hollow spaces between pieces of gypsum board over 1/8 inch 3 mm wide before taping are acceptable.
    b. Rout out backside of gypsum board to accommodate items that extend beyond face of framing, but do not penetrate face of gypsum board, such as metal door frame mounting brackets, etc.
2. Single Layer Application:
    a. Apply ceilings first using minimum of two men.
    b. Use board of length to give minimum number of joints.
    c. Stagger end joints. End and edge joints of board applied on ceilings shall occur over framing members or be back blocked with 2x4 38 mm by 89 mm blocking.
    d. Butt edges in moderate contact. Do not force in place. Shim to level.
    e. Leave facings true with joint, finishing flush. Ceiling surfaces level.
    f. Scribe work closely. Keep joints as far from openings as possible.
    g. Install board tight against support with joints even and true. Tighten loose screws.
3. Fastening:
    a. Apply from center of board towards ends and edges.
    b. Apply screws 3/8 inch 10 mm minimum from ends and edges, one inch 25 mm maximum from edges, and 1/2 inch 13 mm maximum from ends.
    c. Spacing:
        1) Ends: Screws not over 7 inches 175 mm on center at edges where blocking or framing occurs.
        2) Wood Framed Walls And Ceilings: Screws 7 inches 175 mm on center in panel field.
    d. Set screw heads 1/32 inch 0.8 mm below plane of board, but do not break face paper. If face is accidentally broken, apply additional screw 2 inches 50 mm away.
    e. Screws on adjacent ends or edges shall be opposite each other.
    f. Drive screws with shank perpendicular to face of board.
4. Trim:
    a. Edge Trim: Apply where gypsum board abuts dissimilar material in accordance with Manufacturer's instructions. Hold channel and 'L' trim back from exterior metal window and metal door frames 1/8 inch 3 mm to allow for calking.
5. Finishing:
    a. General:
        1) Tape and finish joints and corners throughout building as specified below to correspond with final finish material to be applied to gypsum board. When sanding, do not raise nap of gypsum board face paper or paper-faced trim.
        2) First Coat:
            a) Apply tape over center of joint in complete, uniform bed of specified taping compound and wipe with a joint knife leaving a thin coating of joint compound. If metal corner bead is used, apply reinforcing tape over flange of metal corner bead and trim so half of tape width is on flange and half is on gypsum board.
            b) Completely fill gouges, dents, and fastener dimples.
            c) Allow to dry and sand lightly if necessary to eliminate high spots or excessive compound.
        3) Second Coat:
            a) Apply coat of specified joint compound over embedded tape extending 3-1/2 inches88 mm on both sides of joint center. Use finishing compound only if applied coat is intended as final coat.
            b) Re-coat gouges, dents, and fastener dimples.
            c) Allow to dry and sand lightly to eliminate high spots or excessive compound.
        4) Third Coat: Apply same as second coat except extend application 6 inches 150 mm on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
        5) Fourth Coat: Apply same as second coat except extend application 9 inches 425 mm on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
    b. Finishing Levels:
        1) Gypsum Board Surfaces to Receive Painted Texturing and Smooth Gypsum Board Surfaces in Mechanical, Storage, And Utility Areas:

a) GA-214-96 Level Four: 'Joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles. Cover fastener heads, and accessories with three separate coats of joint compound. Joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer / surfacer.'

3.2 CLEANING

A. Remove from site debris resulting from work of this Section including taping compound spills.

END OF SECTION

SECTION 09 3005

TILE SETTING MATERIALS AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of tile setting materials and accessories furnished and installed under other Sections.

B. Related Sections:
   1. Section 22 1313: Floor drains.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A118.1-1999, ‘Specifications for Dry-Set Portland Cement Mortar.’
   2. ANSI A118.4-1999, ‘Specifications for Latex Portland Cement Mortar.’

B. American Society For Testing And Materials:
   1. ASTM A 185-02, 'Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.'
   2. ASTM C 144-03, 'Standard Specification for Aggregate for Masonry Mortar.'
   3. ASTM C 150-04, 'Standard Specification for Portland Cement.'
   4. ASTM C 206-03, 'Standard Specification for Finishing Hydrated Lime.'
   5. ASTM C 207-01, 'Standard Specification for Hydrated Lime for Masonry Purposes.'
   6. ASTM C 847-95 (2000), 'Standard Specification for Metal Lath.'
   7. ASTM C 1178-01, 'Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.'

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in their original unopened containers with labels intact until time of use. Store and handle materials in a manner to prevent damage or contamination by water, freezing, or foreign matter.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Setting Bed:
   1. Portland Cement: Meet requirements of ASTM C 150, Type 1, designation shall appear on bag.
   2. Hydrated Lime:
      a. Meet requirements of one of following:
         1) ASTM C 206.
         2) ASTM C 207, Type S (designation shall appear on bag).
   3. Sand: Clean, washed, well-graded, meeting requirements of ASTM C 144 with gradation of 100 percent passing No. 8 sieve with not over 5 percent passing No. 100 sieve.

B. Latex-Portland Cement Mortar:
   1. Ceramic Floor Tile Setting Mortar:
      a. Meet requirements of ANSI A118.4 for manufactured mortar.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
         1) Tile Mate Dry-Set Mortar with Hydroment Multipurpose Acrylic Latex Mortar Admixture by Bostik.
         2) Permabond Dry-Set Mortar with C-Crylic 200 Acrylic Admix by C-Cure.
         3) Custom Thinset Mortar Dry-Set Mortar with Acrylic Mortar Admix by Custom.
         4) 272 Floor 'N' Wall Thinset with 40 Acrylic Admix, or 254 Platinum Thinset by Laticrete.
         5) Kerabond Premium Floor & Wall Dry-Set Mortar with Keraply Acrylic Latex Dry-Set Mortar Additive by Mapei.
         6) S-777 Thin Set Mortar with S-810 Copolymer Latex by Summitville Labs.
         7) Full Set Plus with XtraFlex Admix by TEC.

C. Dry-Set Portland Cement Mortar:
   1. Glazed White Body Wall Tile Setting Mortar:
      a. Meet requirements of ANSI A118.1 for manufactured mortar.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
         1) Tile Mate by Bostik.
         2) Permabond by C-Cure.
         3) Custom Thinset by Custom.
         4) 253 Gold Multi-Purpose Thin Set by Laticrete.
         5) Kerabond by Mapei.
         6) Thin-Set 700 by Mer-Krete Systems.
         7) S-777 by Summitville Labs.
         8) Latex-Modified Thin Set Mortar 345 by TEC.

D. Joint Sealants:
   1. Standard color to closely match grout joints as selected by Architect.
   2. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. Tub, Tile, And Ceramic Silicone Sealant by Dow Corning.
      b. Sanitary 1700 by General Electric.
      c. Latisil Sealant by Laticrete.
      d. Pro-Select Kitchen And Bath Silicone Sealant by Sherwin Williams.

E. Commercial Epoxy Grout: All floors and base and walls in restrooms and all shower surfaces.
   1. Sanded.
   2. Color as selected by Architect.
   3. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. Easy-Clean Grout by ColorFast.
      b. SpectraLOCK PRO by Laticrete.
      c. Kerapoxy by Mapei.
      d. Mer-Poxy 420 by Mer-Krete Systems.
      e. S-400 Epoxy-Set Grout by Summitville Labs.
      f. TA-470 Epoxy Mortar & Grout by TEC.

F. Commercial Portland Cement Non-Sanded Grout:
   1. Color as selected by Architect.
   2. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. Bonsal Polymer Modified Unsanded Tile Grout by Bonsal American.
      b. Dry Tile Grout with Hydroment Multi-Purpose Acrylic Latex Grout Additive by Bostik.
      c. 1600 Series Unsanded Dry Set Wall Grout with 1776 Grout Admix Plus additive by Laticrete.
      d. Keracolor-U Unsanded Polymer-Modified Grout by Mapei.
      e. S-667 Unsanded Joint Filler with S-775 Acrylic Latex Additive by Summitville Labs.
      f. TA-610 Unsanded Wall Grout by TEC.

G. Penetrating Sealer:
   1. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
      a. 511 Impregnator by Miracle Sealants.

b. Sealer's Choice by Aqua Mix.

2.2 MANUFACTURERS

A. Contact Information:
1. Aqua Mix Inc, Santa Fe Springs, CA www.aquamix.com.
2. Bonsal American, Charlotte, NC (800) www.bonsal.com.
3. Bostik Construction Products, Middleton, MA www.bostik-us.com.
4. C-Cure Chemical Co Inc, Houston, TX www.c-cure.com.
5. ColorFast Industries Inc, Colton, CA www.colorfastind.com.
6. Custom Building Products, Seal Beach, CA www.custombuildingproducts.com.
7. DalTile - Dallas Ceramics, Dallas, TX www.daltile.com.
8. Dow Corning Corp, Midland, MI www.dowcorning.com.
9. G E Silicone Products, Waterford, NY www.gesilicones.com.
10. Georgia Pacific Gypsum Corp, Atlanta, GA www.gp.com.
11. Laticrete International Inc, Bethany, CT www.laticrete.com.
12. Mapei, Deerfield Beach, FL www.mapei.com.
13. Mer-Krete Systems, Torrance, CA www.merkote.com.
14. Miracle Sealants Co, Arcadia, CA www.miraclesealants.com.
15. NAC - National Applied Construction Products, Akron, OH www.nac-anti-fracture.com.
16. The Noble Company, Grand Haven, MI www.noblecompany.com.
17. Schluter Systems LP, Plattsburgh, NY www.schluter.com.
18. Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
19. Summitville Labs, Summitville, OH www.summitville.com.
20. TEC Inc, Palatine, IL www.tecspecialty.com.

2.3 MIXES

A. Setting Beds:

	Portland Cement	Dry Sand	Damp Sand	Hydrated Lime*
Floor Mix	One Part	5 Parts	4 Part	1/10 Part
Wall Mix	One Part	- -	5-1/2 to 7 Parts	1/2 Part

* Optional
** Use waterproofing admixture. Mix dry then add minimum amount of water.

PART 3 - EXECUTION: Not Used

END OF SECTION

B L A N K P A G E

SECTION 09 3013

CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install ceramic tile and tile setting materials and accessories as described in Contract Documents.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A137.1-1988, 'Ceramic Tile.'

B. Tile Council of North America:
   1. TCNA Handbook, 'Handbook for Ceramic Tile Installation, 2006.'

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's cut sheets of materials used in installed system.
   2. Cleaning and maintenance instructions.
   3. Color and pattern selections.

B. Samples:
   1. 24 inch 600 mm square sample on specified tile backer showing all types of tile, grout, and colors specified in this Section. 1/2 of sample board shall show tile and 1/2 of board shall show wall tile.
   2. One sample of each type of base tile and trim piece to be used on Project.

C. Quality Assurance / Control: Master grade certificate.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in their original unopened containers with labels intact until time of use. Store and handle materials in a manner to prevent damage or contamination by water, freezing, or foreign matter.

B. Keep grade seals intact and cartons dry until tile are used.

1.5 PROJECT CONDITIONS

A. Project Environmental Requirements: Keep ambient temperatures of area to receive tile work and surface temperatures of substrates at 50 deg F 10 deg C minimum during preparation of mortar bed, laying of tile, and for 72 hours after completion of tile work. Use electric heat to prevent discoloration of grout.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Tile:
   1. Tile shall be standard quality, white or off-white body, square or cushion edge, graded in accordance with ANSI A137.1.
      a. Field tile shall have two lugs on each edge to assure uniform joint, approximately 0.040 inch one mm.
      b. External and internal corner pieces shall be standard grade.
   2. Floor Tile:
      a. Porcelain mosaic floor tile. Furnish shower and restroom floors in non-slip, non-abrasive surface.
      b. Tile Size: 2 inch 50 mm square nominal.
      c. Color Quality Standards:
         1) Floors: Group 2 by DalTile.
   3. Wall:
      a. Walls:
         1) Square edge, white body, lug type.
         2) 4-1/4 inches by 4-1/4 inches 108 mm by 108 mm.
      b. Ceramic Tile Base: 4-1/4 inch 108 mm high tile base. When base only is installed at painted walls, use one course of base and one course of bull-nose wall tile.
      c. Color Performance Standards:
         1) Room Walls Group 2 by DalTile.
      d. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
         1) Bright Glaze or Matte Glaze Series by American Olean.
         2) Semi-Gloss or Matte by Dal-Tile.
         3) IC Brites Series by Interceramics.
         4) Jerusalem Stone, Dolce Casa, or Renascence by Portobello.
         5) Bright Glaze of Matte Glaze Series by Laufen.

2.2 MANUFACTURERS

A. Contact Information:
   1. American Olean Tile Co, Div Dal-Tile International, Lansdale, PA www.aotile.com
   2. Dal-Tile - Dallas Ceramics, Dallas, TX www.daltile.com
   3. Interceramic USA, Garland, TX www.interceramicusa.com
   4. Portobello America, Anaheim, CA www.portobelloamerica.net
   5. United States Ceramic Tile, East Sparta, OH www.laufenusa.com

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Plane of Vertical Surfaces: 1/8 inch in 8 feet 3 mm in 2 400 mm from required plane. Shall be plumb and true with square corners.

3.2 PREPARATION

A. Allow concrete to cure for 28 days minimum before application of setting bed.

B. Grounds, anchors, plugs, hangers, door frames, electrical, mechanical, and other work in or behind tile shall be installed before tile work is started.

3.3 INSTALLATION

A. General:
   1. Install in accordance with TCNA standards.
      a. Walls:
      b. Base: Thin-lip or flush style.
   2. Install tile in pattern indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Adjust to minimize tile cutting and to avoid tile less than half size. Center and balance areas of tile if possible.
   3. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruption.
   4. Maintain heights of tile work in full courses to nearest obtainable dimension where heights are given in feet and inchesmeters and millimeters and are not required to fill vertical spaces exactly.
   5. Install cut tile with cuts on outer edges of field. Provide straight cuts that align with adjacent materials. When possible, smooth cut edges of tile or use appropriate cutter or wet saw to produce smooth cuts. Do not install tile with jagged or flaked edges.
   6. Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment. Fit tile closely where edges are to be covered by trim, escutcheons, or similar devices.
   7. Provide straight tile joints of uniform width, subject to variance in tolerance allowed in tile size. Make joints smooth and even, without voids, cracks, or excess mortar or grout.
   8. Accessories in tile work shall be evenly spaced, properly centered with tile joints, and level, plumb, and true to correct projection.
   9. Install tile before mortar has started initial cure. For thin set mortar application, use a notch trowel that will achieve the recommended coverage of mortar after tiles have been installed.
   10. Do not spread more mortar than can be covered within 10 to 15 minutes. If 'skinning' occurs, remove mortar and spread fresh material. Spread mortar with notches running in one direction, perpendicular to pressing, pushing and pulling of tile during placement.
   11. Place tile in fresh mortar, press, push and pull tile slightly to achieve as near 100 percent coverage and contact of tile with setting material and substrate as possible. Coverage shall be 85 percent minimum and be sufficiently distributed to give full support of the tile. Support corners and edges with mortar leaving no hollow corners or edges.
   12. Install so there is 1/8 inch 3 mm of mortar between tile and substrate after proper bedding. Periodically remove sheets or individual tiles to assure proper bond coverage consistent with industry specifications. If coverage is found to be insufficient, use a larger size notch trowel.
   13. Use a beating block and hammer or rubber mallet so faces and edges of individual tiles are flush and level with faces and edges of adjacent tiles, and to reduce lippage.
   14. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

B. Application to Walls:
   1. Provide thick setting bed on CMU:

C. Penetrating Sealers:
   1. Thoroughly clean tile.
   2. Apply on day following installation of Portland cement grout.
   3. Wipe two thin coats with white cotton towel or cloth with each coat applied 90 degrees to each other. Allow 30 minutes between coats. Do not allow contact with epoxy grout.

D. Application of Joint Sealants And Grout:
   1. Grout Types: Use Portland cement grout with wall tile.
   2. Firmly set tile before applying grout. This requires 48 hours minimum.
   3. Remove spacers or ropes before grouting.
   4. Firmly set tile before applying joint sealants or grout. This requires 48 hours minimum.
   5. Remove spacers or ropes before applying joint sealants or grouting. Apply sealants before applying grout.
   6. Apply backer rod and joint sealants at expansion joints. Apply bead of sealant at junction of base and floor tile.

7. Before grouting entire area, do a test area to assure there will be no permanent staining or discoloration of tile and to verify that excess grout can be easily removed from tile surface. If necessary, pre-coat exposed surfaces of tile with a grout release recommended by Grout Manufacturer to facilitate removal of excess grout.
8. Use clean buckets and mixing tools. Use sufficient pressure and flow grout in progressively to avoid air pockets and voids.
9. Apply grout to produce full, smooth grout joints of uniform width, and free of voids and gaps. Fill joints of cushion edge tile to depth of cushion. Fill joints of square edge tile flush with surface.
10. Remove excess grout from surface of tile before it loses its plasticity or begins to set.
11. Finished grout shall be uniform in color, smooth, and without voids, pin holes, or low spots.

3.4 CLEANING

A. If one has been used, remove grout release and clean tile surfaces so they are free of grout residue and foreign matter. If a grout haze or residue remains, use a suitable grout haze remover or cleaner. Flush surface with clean water before and after cleaning.

3.5 PROTECTION

A. Close to traffic areas where tile is being set and other tile work being done. Keep closed until tile is firmly set. Before, during, and after grouting, keep area clean, dry, and free from foreign materials and airflow that will interfere with setting and curing of grout.

B. After cleaning, provide protective covering and maintain conditions protecting tile work from damage and deterioration. Where tiled surfaces will be subject to equipment or wheel traffic or heavy construction traffic, cover protective covering with 1/4 inch 6 mm hardboard, plywood, or similar material.

END OF SECTION

SECTION 09 9125

INTERIOR PAINTED WOOD

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting woodwork as described in Contract Documents.

B. Related Sections:
   1. Section 09 9001: Common Painting Requirements.

1.2 SYSTEM DESCRIPTION

A. All Other: Use MPI(a) INT 6.3T or U Latex Finish system.

B. Finish Requirements: MPI Premium Grade finish requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gloss / Sheen Level Required: Gloss Level 5.

B. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
   1. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
   2. Woodwork:
      a. Primer Coat: MPI Products 39 or 45.
      b. Finish Coats: MPI Product 153.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. Interface With Other Work:
   1. Where back-priming is required, apply one coat of primer.

C. Spot prime nail holes, cracks, and blemishes before and after puttying.

D. Apply stain blocker or other product recommended by Paint Manufacturer to knots before applying primer coat.

END OF SECTION

B L A N K P A G E

SECTION 09 9321

INTERIOR SEALED CONCRETE FLOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Seal concrete floors that are not tiled.

B. Related Sections:
   1. Section 09 9001: Common Painting And Coating Requirements.

1.2 SYSTEM DESCRIPTION

A. Use MPI(a) INT 3.2F or 3.2G Finish systems.

B. Use MPI Custom Grade requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
   1. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
   2. MPI Products 99 or 104.

PART 3 - EXECUTION

3.1 APPLICATION

A. See appropriate paragraphs of Section 09 9001.

END OF SECTION

B L A N K P A G E

DIVISION 10: SPECIALTIES

10 1000 INFORMATION SPECIALTIES

10 1453 TRAFFIC SIGNAGE
10 1491 MISCELLANEOUS EXTERIOR SIGNAGE

10 2000 INTERIOR SPECIALTIES

10 2113 PHENOLIC TOILET COMPARTMENTS
10 2813 COMMERCIAL TOILET ACCESSORIES

END OF TABLE OF CONTENTS

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SECTION 10 1453

TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnishing and installing of exterior post-mounted site signage and building sign as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Post Foundation Concrete: One cu ft cement, 2 cu ft sand, 4 cu ft gravel, and 5 gallons minimum to 6 gallons maximum of water.

B. Post Setting Grout at Sleeves:
   1. Type Two Acceptable Products:
      a. Normal Construction Grout A by W R Bonsal, Charlotte, NC www.bonsal.com.
      b. Advantage 1107 Grout by Dayton Superior, Miamisburg, OH www.daytonrichmond.com.
      c. NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com.
      d. 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
      e. Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com.
      f. Masterflow 555 Pre-mixed Grout by Master Builders, Cleveland, OH www.masterbuilders.com.
      g. Sonogrout 10K by Sonneborn Building Products, Shakopee, MN www.chemrex.com..
      h. Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
      i. CG-86 Grout by W R Meadows, Elgin, IL www.wrmeadows.com.
      j. Equal as approved by Architect before use. See Section 01 6200.

2.2 MANUFACTURED UNITS

A. Accessible Parking Signs:
   1. Sign graphics and lettering shall be minimum required by agency having jurisdiction.
   2. Sign shall have rounded corners.
   3. Sign shall meet current HEW and ANSI A117.1 accessibility codes.
   4. Letters shall be Helvetica Medium with 1/4 inch 6 mm stroke.

B. Other Signs:

C. Posts:
   1. Type Two Acceptable Products:
      a. Nominal 2 inch 50 mm outside diameter by 7 feet 2 100 mm high with wall thickness equivalent to Schedule 40 with satin-brushed natural finish for aluminum or factory two-part epoxy paint for steel.
      b. 2 inch 50 mm square 14 ga Quik-Punch or Telespar by Allied Tube & Conduit, Harvey, IL www.alliedtube.com.
      c. Equal as approved by Architect before installation. See Section 01 6200.

D. Mounting Sleeves: Nominal 2-1/4 inch 56 mm outside diameter pipe, or 2-1/4 inch 56 mm square 12 ga Quik-Punch, 30 inches 750 mm long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signs square and plumb.

B. Post Foundations:
   1. Except atop retaining walls, mix concrete components thoroughly, place in post foundation holes 8 inches 200 mm in diameter by 36 inches 900 mm deep, and set mounting sleeves. For installation on retaining walls, cast sleeves into retaining wall. Sleeves shall extend 2 inches 50 mm maximum above top of finish concrete elevation.
      a. At mow strips, set top of post foundation below grade sufficient to allow for placing of mow strip.
      b. Where posts are installed before installation of slabs, measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post.
      c. Where posts are installed after installation of slabs, core slab 8 inches 200 mm in diameter minimum to accommodate post foundation.

C. Install post in mounting sleeve so bottom of post is 6 inches 150 mm from top of sleeve. Rivet post to mounting sleeve or bolt using tamper-proof bolts.

END OF SECTION

SECTION 10 1491

MISCELLANEOUS EXTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install code-required exterior building-mounted signs.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Code-Required, Building-Mounted Signs:
   a. Handicap accessible 6”x6” sign at accessible entry to restroom.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signs square and plumb.

END OF SECTION

B L A N K P A G E

SECTION 10 2113

PHENOLIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install phenolic toilet compartments as described in Contract Documents.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature or cut sheet.
   2. Color selection.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Toilet And Miscellaneous Partitions:
   1. Floor-mounted, overhead-braced.
   2. Panels:
      a. Phenolic
      b. Anchors: Non-corrosive.
   3. Plinths: Stainless Steel.
   4. Hardware:
      a. Each Door:
         1) Continuous hinges.
         2) Sliding door bolt.
         3) Door strike and keeper with rubber bumper.
         4) Coat hook / door bumper.
      b. Finish: US 26.

B. Finish And Color:
   1. Color as selected by Architect from Manufacturer’s standard colors.

C. Type One Acceptable Manufacturers:
   1. Knickerbocker Partitions Corp, Freeport, NY www.knickerbockerpartition.com.
   2. Metpar, Westbury, NY www.metpar.com.
   3. Santana Products, Inc. www.hinyhider.com
   4. Equal as Approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pilasters rigid, plumb, and level. Anchor pilaster to floor with 3/8 inch 10 mm minimum threaded studs in expansion shields embedded 2 inches 50 mm into concrete slab below setting bed.

B. Secure panels to walls with two stirrup brackets minimum attached near top and bottom of each panel. Use fasteners of length to provide one inch 25 mm embedment into blocking or masonry.

C. Plinth to be level with and snug to floor.

3.2 ADJUSTING

A. Lubricate hardware as recommended by Manufacturer.

B. Set hinges on out-swinging doors to return to nearly closed position.

C. Perform final adjustments to pilaster leveling devices, door hardware, and other operating parts of partition assembly just before Substantial Completion.

3.3 CLEANING

A. Remove protective masking. Clean exposed surfaces of partitions, hardware, fittings, and accessories.

B. Touch-up minor scratches and other finish imperfections using materials and methods recommended by Manufacturer. Replace damaged or severely scratched materials with new materials.

END OF SECTION

SECTION 10 2813

COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Selected accessories for Rest Rooms.
   2. Custodial Room accessories.

B. Related Sections:
   1. Section 01 1200: Soap dispensers, paper towel dispensers, toilet tissue dispensers and shower rods and curtains furnished and installed by State Parks.
   2. Section 06 1100: Blocking.
   3. Section 06 2001: Installation.

1.2 WARRANTY

A. Manufacturer's standard warranty against rusting.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
   1. Rest Rooms:

      a. Mirrors: Glass with stainless steel channel frame with No. 4 Satin finish.

A & J	AAI	ASI	Bobrick	Bradley	GAMCO
U711	CA Series	0620	B-165	700 Series	C Series

      b. Grab Bars:
         1) Concealed mount, 18 ga 1.27 mm, type 304 stainless steel, 1-1/2 inch 38 mm diameter, and non-slip finish in configuration shown on Drawings.
      c. Folding shower seat: 9561-30 by Bradley or BR956-30 by WR Hardware 1-800-225-2517. (Left hand).

   2. Utility Room:
      a. Utility Shelf: Size as shown on Drawings.

A & J	AAI	ASI	Bobrick	Bradley	GAMCO
UJ13	MN Series	1300 Series	B-224 Series	9933 Series	US Series

2.2 MANUFACTURERS

A. Contact Information:
   1. A & J Washroom Accessories, New Windsor, NY www.ajwashroom.com.
   2. American Accessories Inc (AAI), Denison, TX www.aaiusaonline.com.
   3. American Specialties Inc (ASI), Yonkers, NY www.americanspecialties.com.

4. Bobrick Washroom Equipment Inc, North Hollywood, CA www.bobrick.com.
5. Bradley Corp, Menomonee Falls, WI www.bradleycorp.com.
6. General Accessory Manufacturing Co (GAMCO), Durant, OK www.gamcousa.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install using mounting devices proper for base structure.

B. Where possible, mount like items in adjoining compartments back-to-back on same partition.

END OF SECTION

DIVISION 15: PLUMBING AND MECHANICAL

15 010 MECHANICAL REQUIREMENTS

15 050 BASIC MECHANICAL MATERIALS AND METHODS

15 055 OPERATIONS AND MAINTENANCE MANUALS

15 075 MECHANICAL IDENTIFICATION

15 083 PIPE INSULATION

15 100 VALVES

15 170 MOTORS

15 411 WATER DISTRIBUTION PIPING

15 420 DRAINAGE WASTE AND VENT PIPING

15 425 PLUMBING SPECIALTIES

15 440 PLUMBING FIXTURES

15 462 FUEL –FIRED WATER HEATERS

15 511 RADIANT HEATING PIPING

15 514 FINNED WATER TUBE BOILERS

15 545 CHEMICAL WATER TREATMENT

15 550 BREECHINGS, CHIMNEYS AND STACKS

15 815 METAL DUCTS

15 820 DUCT ACCESSORIES

15 853 POWER VENTILATORS

15 855 DIFFUSERS, REGISTERS AND GRILLES

15 990 TESTING, ADJUSTING AND BALANCING

END OF TABLE OF CONTENTS

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SECTION 15010 - MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.

B. All sections of Division 15 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.

1.2 SCOPE OF WORK

A. The project described herein is the Otter Creek Reservoir Restroom and Shower Facility. This work shall include all labor, materials, equipment, fixtures, and devices for the entire mechanical work and a complete operating and tested installation as required for this project.

1.3 CODES & ORDINANCES

A. All work shall be executed in accordance with all underwriters, public utilities, local and state rules and regulations applicable to the trade affected. Should any change in the plans and Specifications be required to comply with these regulations, the Contractor shall notify the Architect before the time of submitting his bid. After entering into contract, the Contractor will be held to complete all work necessary to meet these requirements without extra expense to the Owner. Where work required by drawings or specifications is above the standard required, it shall be done as shown or specified.

B. Applicable codes:

Utah Boiler and Pressure Vessel Rules and Regulations-1999 Edition

Latest Edition
International Building code- 2006 Edition
International Mechanical Code- 2006 Edition
International Plumbing Code- 2006 Edition
International Fire Code- 2006 Edition

1.4 INDUSTRY STANDARDS

A. All work shall comply with the following standards.

1. Associated Air Balance council (AABC)
2. Air Conditioning and Refrigeration Institute (ARI)
3. Air Diffusion council (ADC)
4. Air Movement and Control Association (AMCA)
5. American Gas Association (AGA)
6. American National Standards Institute (ANSI)

7. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
8. American Society of Mechanical Engineers (ASME)
9. American Society of Testing Materials (ASTM)
10. American Water Works Association (AWWA)
11. Cooling Tower Institute (CTI)
12. ETL Testing Laboratories (ETL)
13. Institute of Electrical and Electronic Engineers (IEEE)
14. Hydronics Institute (HI)
15. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
16. National Fire Protection Association (NFPA)
17. National Electrical Code (NEC)
18. National Electrical Manufacturers Association (NEMA)
19. National Electrical Safety code (NESC)
20. Utah safety Standard (OSHA), Utah State Industrial Council.
21. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
22. Underwriters Laboratories (UL)
23. Tubular Exchanger Manufacturers Association, Inc. (TEMA)
24. Heat Exchanger Institute (HEI)
25. Hydraulic Institute (HI)
26. Thermal Insulation Manufacturer's Association (TIMA)
27. Scientific Apparatus Makers Association (SAMA)

1.5 UTILITIES & FEES

A. All fees for permits required by this work will be paid by this Division. The contractor shall obtain the necessary permits to perform this work. Unless noted otherwise, all systems furnished and or installed by this Contractor, shall be complete with all utilities, components, commodities and accessories required for a fully functioning system. This Contractor shall furnish cleaners and water treatment additives.

1.6 SUBMITTALS AND SHOP DRAWINGS

A. Submittals: As soon as possible after the contract is awarded, but in no case more than 45 calendar days thereafter, the Contractor shall submit to the Architect six (6) copies of the descriptive literature covering products and materials to be used in the installation of mechanical systems for this project. The review of the submitted data will require a minimum of 21 days. If the Contractors schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within 21 days of returned submittals. Refer to each specification section for items requiring submittal review. Written approval of the Owner's Representative shall be obtained before installing any such equipment or materials for the project. The submittals shall be prepared in an orderly manner, contained in a 3-ring loose-leaf binder with index and identification tabs each item or group of items and for each specification section. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within 120 days of the contract award date**. Partial submittals will not be reviewed until the complete submittal is received.**

Submitted literature shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.

Submitted literature shall clearly indicate performance, quality, and utility requirements; shall show

dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.

Submitted literature shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.

Review by the Owner's Representative is for general conformance of the submitted equipment to the project specification. In no way does such review relieve this 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 that may affect his work. Regardless of any items overlooked by the submittal review, the requirements of the contract drawings and specifications must be followed and are not waived or superseded in any way by the review.

By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings or if not listed on the drawings is the equipment first named in the specifications.

If the Engineer is required to do additional design work to incorporate changes caused by submitting equipment or products, different than the design equipment specified, as defined above, the contractor shall reimburse the engineer for additional time and expenses at the engineers current, recognized, hourly rates.

1.7 DRAWINGS AND MEASUREMENTS

A. Construction Drawings: The contract document drawings show the general design, arrangements, and extent of the system. In certain cases, the drawings may include details that show more nearly exact locations and arrangements; however, the locations, as shown diagrammatically, are to be regarded as general.

It shall be the work of this Section to make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. All dimensions given on the drawings shall be verified as related to this work and with the Architect's office before work is started.

This Section shall carefully study building sections, space, clearances, etc., and then provide offsets in piping or ductwork as required to accommodate the building structure without additional cost to the Owner. In any case and at any time, a change in location required by obstacles or the installation of other trades not shown on the mechanical plans shall be made without charge.

The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subcontractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment, piping, ductwork, etc.

The drawings and specifications have been prepared to supplement each other and they shall be interpreted as an integral unit with items shown on one and not the other being furnished and installed

as though shown and called out on both.

B. Coordination Drawings: The contractor shall provide coordination drawings for mechanical rooms, fan rooms, equipment rooms, and congested areas to eliminate conflicts with equipment, piping, or work of other trades. The drawings shall be a minimum scale of 1/4 inch= 1 foot and of such detail as may be required by the Engineer to fully illustrate the work. These drawings shall include all piping, conduit, valves, equipment, and ductwork.

Record Drawings: Refer to Division 1.

1.8 EXISTING CONDITIONS

A. The Contractor shall carefully examine all existing conditions that might affect the mechanical system and shall compare these conditions with all drawings and specifications for work included under this contract. He shall, at such time, ascertain and check all conditions that may affect his work. No allowance shall subsequently be made in his behalf for an extra expense incurred as a result of his failure or neglect to make such examination. This Contractor shall include in his bid proposal all necessary allowances to repair or replace any item that will remain or will be removed, and any item that will be damaged or destroyed by new construction.

B. The Contractor shall remove all abandoned piping, etc., required by new construction and cap or plug openings. No capping, etc., shall be exposed in occupied areas. All openings of items removed shall be sealed to match adjacent surfaces.

C. The Contractor shall verify the exact location of all existing services, utilities, piping, etc., and make connections to existing systems as required or as shown on the drawings. The exact location of each utility line, together with size and elevation, shall be established before any on-site lines are installed. Should elevation or size of existing main utility lines make connections to them impossible as shown on drawings, then notification of such shall immediately be given to the Owners Representative for a decision.

1.9 EQUIPMENT CAPACITIES

A. Capacities shown for equipment in the specifications and on the drawings are the minimum acceptable. No equipment shall be considered as an alternate which has capacities or performance less than that of design equipment.

B. All equipment shall give the specified capacity and performance at the job-site elevation. Manufacturers' standard ratings shall be adjusted accordingly. All capacities and performances listed on drawings or in specifications are for job-site conditions.

1.10 SEISMIC REQUIREMENTS FOR EQUIPMENT

A. All equipment shall be furnished structurally adequate to withstand seismic forces as outlined in the International Building Code and SMACNA GUIDELINES. Refer to section Mechanical Vibration Controls and Seismic Restraints. Equipment bases shall be designed for direct attachment of seismic snubbers and/or seismic anchors.

1.11 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other drawings and parts of this specification that cover work of other

trades that is carried on in conjunction with the mechanical work such that all work can proceed without interference resulting from lack of coordination.

B. The Contractor shall properly size and locate all openings, chases, sleeves, equipment bases, and accesses. He shall provide accurate wiring diagrams to the Electrical Contractor for all equipment furnished under this Division.

C. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing, waste, and soil lines; supply, return, and exhaust ductwork; water piping; medical gases; fire protection piping; and pneumatic control piping.

D. The mechanical Contractor shall insure that the installation of all piping, ducts and equipment is in compliance with Articles 110-16 and 384-4 of the National Electrical Code relative to proper clearances in front of and over all electrical panels and equipment. No piping or ductwork will be allowed to run over electrical panel.

1.12 RESPONSIBILITY OF CONTRACTOR

A. The Contractor is responsible for the installation of a satisfactory piece of work in accordance with the true intent of the drawings and specifications. He shall provide, as a part of his work and without expense, all incidental items required even though these items are not particularly specified or indicated. The installation shall be made so that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order. The Contractor shall familiarize the Owner's Representative with maintenance and lubrication instructions as prepared by the Contractor and shall explain and fully instruct him relative to operating, servicing, and maintenance of them.

1.13 PIPE AND DUCT OPENINGS AND EQUIPMENT RECESSES

A. Pipe and duct chases, openings, and equipment recesses shall be provided by others only if shown on architectural or structural drawings. All openings for the mechanical work, except where plans and specifications indicate otherwise, shall be provided as work of this Division. Include openings information with coordination drawings.

B. Whether chases, recesses, and openings are provided as work of this Division or by others, this Contractor shall supervise their construction and be responsible for the correct size and location even though detailed and dimensioned on the drawings. This Contractor shall pay for all necessary cutting, repairing, and finishing if any are left out or incorrectly made. All necessary openings thru existing walls, ceilings, floors, roofs, etc. shall be provided by this Contractor unless indicated otherwise by the drawing and/or specifications.

1.14 UNFIT OR DAMAGED WORK

A. Any part of this installation that fails, is unfit, or becomes damaged during construction, shall be replaced or otherwise made good. The cost of such remedy shall be the responsibility of this Division.

1.15 WORKMANSHIP

A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative. Nothing contained

herein shall relieve the Contractor from making good and perfect work in all details in construction.

1.16 SAFETY REGULATION

A. The Contractor shall comply with all local, Federal, and OSHA safety requirements in performance with this work. (See General Conditions). This Contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

1.17 ELECTRICAL SERVICES

A. All equipment control wiring and all automatic temperature control wiring including all necessary contacts, relays, and interlocks, whether low or line voltage, except power wiring, shall be furnished and installed as work of this Division unless shown to be furnished by Division 16. All such wiring shall be in conduit as required by electrical codes. Installation of any and all wiring done under Division 15 shall be in accordance with the requirements of Division 16, Electrical.

All equipment that requires an electrical connection shall be furnished so that it will operate properly and deliver full capacity on the electrical service available.

Refer to the electrical 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 furnishing the equipment.

The Mechanical Contractor must coordinate with the Electrical Contractor to insure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.18 WORK, MATERIALS, AND QUALITY OF EQUIPMENT

A. Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and all labor shall be done in a most thorough and workmanlike manner.

B. Products or equipment of any of the manufacturers cited herein or any of the products approved by the Addenda may be used. However, where lists of products are cited herein, the one first listed in the design equipment used in drawings and schedules to establish size, quality, function, and capacity standards. If other than design equipment is used, it shall be carefully checked for access to equipment, electrical and control requirements, valving, and piping. Should changes or additions occur in piping, valving, electrical work, etc., or if the work of other Contractors would be revised by the alternate equipment, the cost of all changes shall be borne as work of this Division.

The Execution portions of the specifications specify what products and materials may be used. Any products listed in the Product section of the specification that are not listed in the Execution portion of the specification may not be used without written approval by the Engineer.

C. The access to equipment shown on the drawings are the minimum acceptable space requirements. No equipment that reduces or restricts accessibility to this or any other equipment will be considered.

D. All major items of equipment are specified in the equipment schedules on the drawings or in these specifications 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 installation.

E. All welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, latest Edition.

1.19 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS

A. All equipment and materials shall be properly stored and protected against moisture, dust, and wind. Coverings or other protection shall be used on all items that may be damaged or rusted or may have performance impaired by adverse weather or moisture conditions. Damage or defect developing before acceptance of the work shall be made good at the Contractor's expense.

B. All open duct and pipe openings shall be adequately covered at all times.

1.20 INSTALLATION CHECK

A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule and the seismic supplier shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.

B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated under full load conditions and that it operated satisfactorily.

C. All costs for this work shall be included in the prices quoted by equipment suppliers.

1.21 EQUIPMENT LUBRICATION

A. The Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. A linen tag shall be attached to each piece of equipment, showing the date of lubrication and the lubricant used. No equipment shall be started until it is properly lubricated.

B. Necessary time shall be spent with the Owner's Representative to thoroughly familiarize him with all necessary lubrications and maintenance that will be required of him.

C. Detergent oil as used for automotive purposes shall not be used for this work.

1.22 CUTTING AND PATCHING

A. No cutting or drilling in structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the mechanical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.

B. When concrete, grading, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.

1.23 EXCAVATION AND BACKFILLING

A. All necessary excavations and backfilling for the Mechanical phase of this project shall be provided as work of this Division. Work shall conform to Division 2, Site Work. Trenches for all underground pipelines shall be excavated to the required depths. The bottom of trenches shall be compacted hard and graded to obtain required fall. Backfill shall be placed in horizontal layers, not exceeding 12 inches in thickness, and properly moistened. Each layer shall be compacted, by suitable equipment, to a density of not less than 95 percent as determined by ASTM D-1557. After pipelines have been tested, inspected, and approved, the trench shall be backfilled with selected material. Excess earth shall be hauled from the job site. Fill materials approved by the Architect shall be provided as work of this Division.

B. No trenches shall be cut near or under any footings without consultation first with the Architect's office. Any trenches or excavations more than 30 inches deep shall be tapered, shored, covered, or otherwise made absolutely safe so that no vehicle or persons can be injured by falling into such excavations, or in any way be harmed by cave-ins, shifting earth, rolling rocks, or by drowning. This protection shall be extended to all persons approaching excavation related to this work whether or not such persons are authorized to be in the vicinity of the construction.

1.24 ACCESS

A. Provide access doors in walls, ceilings and floors, for access to mechanical equipment such as valves, fans, controls, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless otherwise indicated or required. Coordinate location of doors with the Architect prior to installation.

B. Valves: Valve must be installed in locations where access is readily available. If access is compromised, as judged by the Mechanical Engineer, these valves shall be relocated where directed at the Contractors expense.

C. Equipment: Equipment must be installed in locations and orientations so that access to all components requiring service or maintenance will not be compromised. If access is compromised, as judged by the Mechanical Engineer, the contractor shall modify the installation as directed by the Engineer at the Contractors expense.

1.25 CLEANING AND PAINTING

A. Cleaning: After all tests and adjustments have been made and all systems pronounced satisfactory for permanent operation, this Contractor shall clean all exposed piping, ductwork, insulated members, fixture, and equipment installed under this Section and leave them ready for painting. He shall refinish any damaged finish and leave everything in proper working order. The Contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

B. Painting: Painting of exposed pipe, insulated pipe, ducts, or equipment is work of Division 9, Painting.

Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical Contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial

numbers, or other identifying marks.

C. Removal of Debris, Etc: Upon completion of this division of the work, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

1.26 CONTRACT COMPLETION

A. Incomplete and Unacceptable Work: If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor, then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.

B. Maintenance Instructions: The Contractor shall furnish the Owner complete printed and illustrated operating and maintenance instructions covering all units of mechanical equipment, together with parts lists.

C. Instructions To Owner's Representatives: In addition to any detailed instructions called for, the mechanical Contractor must provide, without expense to the Owner, competent instructors to train the Owner's representatives who will be in charge of the apparatus and equipment, in the care, adjustment, and operation of all parts on the heating, air conditioning, ventilating, plumbing, fire protection, and automatic temperature control equipment. Instruction dates shall be scheduled at time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Architect. A minimum of four 8-hour instruction periods shall be provided. The instruction periods will be broken down to shorter periods when requested by the Owner. The total instruction hours shall not reduced. The ATC Contractor shall provide 12 hours of instructions. The remaining hours shall be divided between the mechanical and sheet metal Contractor.

D. Guarantee: By the acceptance of any contract award for the work herein described or shown on the drawings, the Contractor assumes the full responsibility imposed by the guarantee as set forth herein and in the General Conditions, and should protect himself through proper guarantees from equipment and special equipment Contractors and from subcontractors as their interests may appear.

The guarantee so assumed by the Contractor and as work of this Section is as follows:

That the entire mechanical system, including plumbing, heating, and air-conditioning system shall be quiet in operation.

That the circulation of water shall be complete and even.

That all pipes, conduit, and connections shall be perfectly free from foreign matter and pockets and that all other obstructions to the free passage of air, water, liquid, sewage, and vent shall be removed.

That he shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during a period of one year from date of Substantial Completion.

That all specialties, mechanical, and patent devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system; i.e., diffusers shall deliver the designed amount of air shown on drawings, thermostats shall operate to the specified limits, etc.

All equipment and the complete mechanical system shall be guaranteed for a period of one year from the date of the Architect's Certificate of Substantial Completion. Any equipment supplier not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period.

All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.

1.27 TEST RUN

A. The Mechanical Contractor shall operate the mechanical system for a minimum of 30 days to prove the operation of the system.

1.24 EQUIPMENT STARTUP AND CHECKOUT:

A. Each major piece of equipment shall be started and checked out by an authorized representative of the equipment manufacturer. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided and shall be included in the commissioning report.

END OF SECTION 15010

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SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
9. Non-shrink grout for equipment installations.
10. Field-fabricated metal equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touch up painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Shop Drawings: Detail fabrication and installation for metal supports and anchorage for mechanical materials and equipment.

C. Coordination Drawings: For access panel and door locations.

D. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

E. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. 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.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

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 the following:

1. Dielectric Unions:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Eclipse, Inc.; Rockford-Eclipse Div.
   d. Epco Sales Inc.
   e. Hart Industries International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.
   d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

   a. Calpico, Inc.
   b. Central Plastics Co.

4. Dielectric Couplings:

   a. Calpico, Inc.
   b. Lochinvar Corp.

5. Dielectric Nipples:

   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

   a. ANAMET Industrial, Inc.
   b. Central Sprink, Inc.
   c. Flexicraft Industries.
   d. Flex-Weld, Inc.
   e. Grinnell Corp.; Grinnell Supply Sales Co.
   f. Hyspan Precision Products, Inc.
   g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
   h. Mercer Rubber Co.
   i. Metraflex Co.
   j. Proco Products, Inc.
   k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

   a. General Rubber Corp.
   b. Mercer Rubber Co.
   c. Metraflex Co.

d. Proco Products, Inc.
e. Red Valve Co., Inc.
f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal.
d. Linkseal

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.

2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS and Smaller: Threaded.
2. 2-1/2-Inch NPS and Larger: Flanged.
3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

D. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated. Limited to non-potable water use.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve.

Under this section there shall be furnished and installed a complete Link-Seal® modular seal assembly, manufactured by PSI-Thunderline/Link-Seal® located at 6525 Goforth Street, Houston, TX 77021, as shown on drawings and specifications. For clarification, complete assembly is defined as a combined:

Wall opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole). The wall opening size and/or type shall be selected according to recommendations found in the most recent Link-Seal® modular seal catalog.

Sufficient quantity and type of Link-Seal® modular seals required to effectively provide a hydrostatic and/or fire-rated seal.

Each individual link shall be conspicuously and permanently identified with the name of the manufacturer and model number. Manufacturers other than the above-named company wishing to quote equipment in this section shall submit detail drawings of their proposed equipment and suitable evidence of a minimum of 25 years of experience and results to the engineer to obtain written approval to quote at least ten (10) days prior to bid opening.

Link-Seal® Modular Seal Rubber Links
Shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.

For Standard Service Applications
-40 to +250ºF (-40 to +121ºC)
EPDM = ATSM D2000 M3 BA510
Color = Black

For Hydrocarbon Service Applications
-40 to +210ºF (-40 to +99ºC)
Nitrile = ASTM D2000 M1BF510
Color = Green

For High Temperature or Fire Seal Applications
-67 to +400ºF (-55 to +204ºC)
Silicone = ASTM D2000 M1GE505
Color = Gray
Reference shall always be made to the latest published Link-Seal® modular seal selection guide for the service intended.

Link-Seal® Modular Seal Pressure Plates

Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
Flexural Strength @ Yield = 30,750 psi per ASTM D-790
Flexural Modulus = 1,124,000 psi per ASTM D-790
Elongation Break = 11.07% per ASTM D-638
Specific Gravity = 1.38 per ASTM D-792

Models LS200-275-300-315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-525-575-600 shall incorporate an integral recess known as a “Hex Nut Interlock” designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer’s name molded into it.

For fire and Hi-Temp service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.

Link-Seal® Modular Seal Hardware
All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be:

316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

   a. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

   a. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with spring clips and chrome-plated finish.
6. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
8. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
Design Mix: 5000-psig, 28-day compressive strength.
Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.

2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.

3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.

4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.

5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.

5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

U. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.

7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. ABS Piping: ASTM D 2235 and ASTM D 2661.
    c. CPVC Piping: ASTM D 2846 and ASTM F 493.
    d. PVC Pressure Piping: ASTM D 2672.
    e. PVC Nonpressure Piping: ASTM D 2855.
    f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.

V. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

W. Wall Opening

1. Century-Line® Sleeves - for openings to 24.81” diameter.
   Where pipes must pass through walls and floors of new structures, unless otherwise shown or specified, install molded non-metallic high density polyethylene Model CS Century-Line® sleeves as manufactured by PSI-Thunderline/Link-Seal®. Model CS sleeves shall have integrally formed hollow water stop sized having a minimum of four inches larger than the outside diameter of the sleeve itself and allowing 1/2” movement between wall forms to resist pour forces. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.

Link-Seal® Modular Seal components and systems shall be domestically manufactured at a plant with a current ISO-9002 registration. Copy of ISO-9002 registrations shall be a submittal item.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exterior exposed piping, interior and exterior stands, supports and frames according to the following, unless otherwise indicated:

1. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Exterior, Ferrous Frames, stands and Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
3. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

A. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout.

C. Avoid air entrapment during placing of grout.

D. Place grout, completely filling equipment bases.

E. Place grout on concrete bases to provide smooth bearing surface for equipment.

F. Place grout around anchors.

G. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 15050

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SECTION 15055 - OPERATIONS & MAINTENANCE MANUALS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. All pertinent sections of Division 15 Mechanical General Requirements, are part of the work of this Section. Division 1 is part of this and all other sections of these specifications.

1. Testing and Balancing is specified in section 15990.
2. Training and Instructions to Owner's Representative is specified in section 15010.

1.2 SCOPE OF WORK

A. Submission of Operating and Maintenance Manuals complete with Balancing reports. (Coordinate with Division 1).

B. Coordination of work required for system commissioning.

1.3 SUBMITTALS

A. Submit product data in accordance with Division 1 and Section 15010. Submit the following:

B. Sample of O and M manual outline.

PART 2 - PRODUCTS

2.1 O & M MANUALS

A. The operating and maintenance manuals shall be as follows:

1. Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows: (coordinate with Section 1730)

OPERATING AND MAINTENANCE
MANUAL
FOR THE

OTTER CREEK RESEVOIR
RESTROOM & SHOWER FACILITY

2007

VOLUME No. ( )

VAN BOERUM & FRANK ASSOCIATES, INC.
MECHANICAL ENGINEER

CAMPBELL ASSOCIATES
ARCHITECTS

Binders shall be a manufactured by Hiller Bookbinding.

PART 3- EXECUTION

3.1 OPERATING AND MAINTENANCE MANUALS:

A. Work under this section shall be performed in concert with the contractor performing the system testing and balancing. Six (6) copies of the manuals shall be furnished to the Architect for distribution to the owner.

B. The "Start-Up and Operation" section is one of the most important in the manual. Information in this section shall be complete and accurately written and shall be verified with the actual equipment on the job, such as switches, starters, relays, automatic controls, etc. A step-by-step start-up procedure shall be described.

C. The manuals shall include Air-balancing reports, water-balancing reports, system commissioning procedures, start-up tests and reports, equipment and system performance test reports, warranties, and certificates of training given to the owner's representatives.

D. An index sheet typed on AICO Gold-Line indexes shall be provided in the front of the binder. The manual shall be include the following:

SYSTEM DESCRIPTIONS

START-UP PROCEDURE AND OPERATION OF SYSTEM

MAINTENANCE AND LUBRICATION TABLE

OPERATION AND MAINTENANCE BULLETINS

AUTOMATIC TEMPERATURE CONTROL DESCRIPTION OF OPERATION, INTERLOCK AND CONTROL DIAGRAMS, AND CONTROL PANELS.

AIR AND WATER SYSTEM BALANCING REPORTS

EQUIPMENT WARRANTIES AND TRAINING CERTIFICATES

SYSTEM COMMISSIONING REPORTS

EQUIPMENT START-UP CERTIFICATES

END OF SECTION 15055

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SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. Product Data: For identification materials and devices.

B. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Stencil Paint: Exterior, oil-based, alkyd gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
2. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

F. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

G. Lettering: Manufacturer's standard preprinted captions as selected by Engineer.

H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

I. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cold-air supply.
2. Yellow: Hot-air supply.
3. Blue: Exhaust, outside, return, and mixed air.
4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, polished brass..
2. Size: 1-1/2-inches diameter, unless otherwise required.
3. Indicate valve service and normal position on valve. Example Cold water, N.O.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Valve Tag Fasteners: Brass, wire-link chain; beaded chain; or S-hooks.

N. Access Panel Markers: 1/16-inch- thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch center hole for attachment.

O. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Marker Type: Stenciled markers with painted, color-coded bands complying with ASME A13.1.

C. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

D. Fasten markers on pipes and insulated pipes by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.
2. Adhesive lap joint in pipe marker overlap.
3. Laminated or bonded application of pipe marker to pipe or insulation.
4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch wide, lapped a minimum of 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
5. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2

inches wide, lapped a minimum of 3 inches at both ends of pipe marker, and covering full circumference of pipe.

E. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 VALVE TAGS

A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. Indicate service and normal position of all tagged valve and control devices. List tagged valves in valve schedule.

B. Tag Material: Brass.

3.3 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Fire department hose valves and hose stations.
3. Meters, gages, thermometers, and similar units.
4. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
5. Pumps, compressors, chillers, condensers, and similar motor-driven units.
6. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
7. Fans, blowers, primary balancing dampers, and mixing boxes.
8. Packaged HVAC central-station and zone-type units.
9. Tanks and pressure vessels.
10. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

B. Optional Sign Types: Stenciled signs may be provided instead of engraved plastic, at Installer's option, where lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.

1. Lettering Size: Minimum 1/4 inch for name of units if viewing distance is less than 24

inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2. Terms on Signs: Distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.

1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 15075

SECTION 15083 - PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

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

1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
2. Attachment and covering of heat trace inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties and equipment connections.
6. Application of field-applied jackets.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those

specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

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. Mineral-Fiber Insulation:

   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

   a. Armstrong World Industries, Inc.
   b. Rubatex Corp.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

    a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
    b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

2.4 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

   1. Apply insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
   3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

S. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply metered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive. Color for each piping system shall be selected by the Architect.

B. PVC jacketing shall be installed on all piping in the tunnels which has insulation. See Section 3.10 for Application of PVC or Aluminum jacketing.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Below-grade piping, unless otherwise indicated.
4. Chrome-plated pipes and fittings, unless potential for personnel injury.
5. Non-Chilled water air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F.
2. Insulation Material: Mineral fiber with reinforced all service Jacket.
3. Insulation Thickness: see table A
4. Field-Applied Jacket: PVC (Mechanical Rooms and where exposed)
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Domestic, cold water systems.

1. Operating Temperature: 35 to 60 deg F.
2. Insulation Material: Mineral Fiber will reinforced all service jacket.
3. Insulation Thickness: 1 inch for lines 1" and smaller, 1inch for lines 1 1/4" and larger.
4. Field-Applied Jacket: PVC (Mechanical Rooms and where exposed)
5. Vapor Retarder Required: Yes.
6. Finish: None.

C. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

1. Operating Temperature: 35 to 120 deg F..
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: 1 inch.
4. Field-Applied Jacket: PVC P-trap and supply covers.
5. Vapor Retarder Required: No.
6. Finish: None.

END OF SECTION 15083

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SECTION 15100 - VALVES

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 general duty valves common to several mechanical piping systems.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Special purpose valves are specified in Division 15 piping system Sections.
2. Valve tags and charts are specified in Division 15 Section "Mechanical Identification."

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 valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set globe and gate valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Center Line
2. Conbraco Industries, Inc., Apollo Division
3. Cla-Val Company
4. Grinnell Corporation
5. Hammond Valve Corporation
6. Keystone Valve USA, Inc.
7. Metraflex Company
8. Milwaukee Valve Company, Inc.
9. NIBCO, Inc.
10. Stockham Valves & Fittings, Inc.
11. Val-Matic Valve & Mfg. Corporation
12. Victaulic Company of America
13. Bray

2.2 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.

1. Nonrising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

2.3 GATE VALVES

A. No gate valves will be used on this project.

2.4 BALL VALVES

A. Ball Valves, 2 Inches and Smaller: MSS SP-110, 600-psi CWP, ASTM B 584 ,B 61 or B 62 bronze body (containing no more than 15% zinc), 2-piece construction; chrome-plated, full port, brass ball; blowout proof; silicon- bronze or silicon-brass stem; teflon seats and seals; threaded or soldered end connections, valves for HVAC, steam and condensate service must have threaded end connections:

1. Operator: Vinyl-covered steel lever handle for sizes 2-1/2" and smaller.
2. Operator: Lever operators with lock for sizes 3" and larger.
3. Valves shall be equipped with 2" extended handles of non-thermal conductive material. Also provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Supply with memory stops, which are fully adjustable after insulation is applied.
4. Memory Stop: For operator handles.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

3.3 SOLDERED CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to fully open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Steel Pipe Sizes, 2-1/2 Inches and Smaller: Threaded or grooved end.

3.6 APPLICATION

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

3.7 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION 15100
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SECTION 15170 - MOTORS

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 basic requirements for factory-installed and field-installed motors.

B. Related Sections include the following:

1. Division 15 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.3 SUBMITTALS

A. Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Factory Test Reports: For specified tests.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Listing and Labeling: Provide motors specified in this Section that are listed and labeled.

1. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 BASIC MOTOR REQUIREMENTS

A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

B. Motors 3/4 HP and Larger: Polyphase.

C. Motors Smaller than 3/4 HP: Single phase.

D. Frequency Rating: 60 Hz.

E. Voltage Rating: Determined by voltage of circuit to which motor is connected.

F. Service Factor: According to NEMA MG 1, unless otherwise indicated.

G. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Open dripproof, unless otherwise indicated.

2.2 POLYPHASE MOTORS

A. Description: NEMA MG 1, medium induction motor.

1. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
2. Energy-Efficient Design: Where indicated.
3. Stator: Copper windings, unless otherwise indicated. Multispeed motors have separate winding for each speed.
4. Rotor: Squirrel cage, unless otherwise indicated.
5. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating, unless otherwise indicated.
7. Insulation: Class F, unless otherwise indicated.
8. Class B Motor temperature rise.
9. Premium efficiency rated.

B. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

C. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Critical vibration frequencies are not within operating range of controller output.
2. Temperature Rise: Match rating for Class B insulation.
3. Insulation: Class F.
4. Thermal Protection: Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.
5. Bearings: Motor bearings shall be rated for an L-10 life in excess of 200,000 hours of continuous duty and shall be of the regreasable type with plugged drain fittings.
6. Service factor 1.15.

D. Rugged-Duty Motors: Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with nonhygroscopic material. External finish is chemical-resistant paint over corrosion-resistant primer.

E. Source Quality Control: Perform the following routine tests according to NEMA MG 1:

1. Measurement of winding resistance.
2. No-load readings of current and speed at rated voltage and frequency.

3. Locked rotor current at rated frequency.
4. High-potential test.
5. Alignment.
6. Document all tests and include in O&M Manual.

2.3 SINGLE-PHASE MOTORS

A. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.

C. Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.

D. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, prelubricated sleeve bearings for other single-phase motors.

E. Motors are to have the ECM label.

PART 3 - EXECUTION

3.1 ADJUSTING

A. Use adjustable motor mounting bases for belt-driven motors.

B. Align pulleys and install belts.

C. Tension according to manufacturer's written instructions.

END OF SECTION 15170

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SECTION 15411 - WATER DISTRIBUTION PIPING

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 water distribution piping from locations indicated to fixtures and equipment inside building.

B. Related Sections include the following:

1. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

A. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Water Distribution Piping: 125 psig.

1.5 SUBMITTALS

A. Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

1.6 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 61, “Drinking Water System Components–Health Effects,” Sections 1 through 9 for potable-water piping and components.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

C. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

C. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

E. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

D. Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.

E. Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 VALVES

A. Refer to Division 15 Section "Valves" for general-duty valves.

B. Refer to Division 15 Section "Plumbing Specialties" for special-duty valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch NPS and Smaller: Soft copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.

D. Aboveground, Water Distribution Piping: Use the following:

1. 2-Inch NPS and Smaller: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints or Hard copper tube, Type L with grooved ends; copper, grooved-end fittings; and copper, keyed couplings..

E. Underground, Water Distribution Piping: Do not use flanges or valves underground.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball, or butterfly valves.
2. Throttling Duty: Use globe, ball, or butterfly valves.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

C. Install water-pressure regulators downstream from shutoff valves.

3.6 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping with 0.25 percent slope downward toward drain.

3.7 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.8 VALVE INSTALLATION

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS and larger.

B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS and larger.

C. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.
3. Provide permanently affixed chains and caps.

3.9 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet and less.
3. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet.
4. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet.
5. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet or longer. Support pipe rolls on trapeze.
6. Spring hangers, MSS Type 52, for supporting base of vertical runs.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers with the following maximum spacing and minimum rod diameters:

Pipe Size	Rod Diameter	Maximum Spacing

1 1/4 in. and smaller	½ in.	6 ft.
1-1/2 in. and 2 in.	½ in.	9 ft.
2-1/2 in. and 2 in.	5/8 in.	10 ft.

In addition to the spacing listed, an additional hanger shall be provided 1 foot 0 inches from each pipe drop, rise or turn.

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

1. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
2. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS and larger.

3.11 FIELD QUALITY CONTROL

A. Inspect water distribution piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

   a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test water distribution piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.12 CLEANING

A. Clean and disinfect potable service entrance piping and water distribution piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:

      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for 3 hours.

   c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.13 COMMISSIONING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

END OF SECTION 15411

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SECTION 15420 - DRAINAGE WASTE AND VENT PIPING

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 soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

B. Related Sections include the following:

1. Division 15 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.
2. Division 2 Section: Sewage and Drainage, for sanitary sewage.
3. Division 2 Section: Excavation and Backfill, for excavation and compaction.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 15-foot head of water

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings: For drainage system, include plans, elevations, sections, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency

B. Comply with ASME B31.9 FC materials, products and installation.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. See "Writing Guide" Article in the Evaluations for a discussion of this Section's organization and the most efficient way to edit this Section.

C. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

D. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve. ***Couplings shall conform to ASTM-c 1540. By Husky SD4000 and clamp all 125. This applies to all this section.***

1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide shield with 4 bands.

b. Heavy-Duty, FM-Approved Couplings: ASTM A 666, Type 304, stainless-steel housing; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide housing with 2 bands.

c. Heavy-Duty, Cast-Iron Couplings: ASTM A 48, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and sleeve.

d. Couplings in subparagraph and associated subparagraphs below are suitable for installation underground and in high-rise buildings but may not be suitable for installation in corrosive soil or in corrosive atmospheres.

e. Heavy-Duty, Type 301, Stainless-Steel Couplings: ASTM A 666, Type 301, stainless-steel shield; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide shield with 4 bands.

f. Compact, Stainless-Steel Couplings: CISPI 310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 2-1/8-inch- (54-mm-) wide shield with 2 bands.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:

a. Couplings: Heavy-duty, Type 301, stainless steel. The stainless steel is to be type 304. Use Husky SD4000, clamp all 125 or mg. This applies to all this section.
b. Couplings: Heavy-duty, cast iron.
c. Couplings: Compact, stainless steel.

D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:

a. Couplings: Heavy-duty, Type 304, stainless steel.

3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

F. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."Delete subparagraph below if not required.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for seismic-restraint devices.

B. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Maximum spans below were taken from MSS SP-69 for water service and from model plumbing codes. Most restrictive piping and spacing dimensions are shown.

G. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.

7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack

openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15420

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SECTION 15425 - PLUMBING 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 plumbing specialties for the following:

1. Water distribution systems.
2. Soil, waste, and vent systems.

B. Related Sections include the following:

1. Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
2. Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
3. Division 15 Section "Mechanical Identification" for labeling and identifying requirements.
4. Division 15 Section "Water Distribution Piping" for water-supply piping and connections.
5. Division 15 Section "Drainage and Vent Piping" for drainage and vent piping and connections.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Water Distribution Piping: 125 psig.
2. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

C. Listing and Labeling: Provide electrically operated plumbing specialties specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

D. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

E. Comply with NFPA 70, "National Electrical Code," for electrical components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Water Regulators:

   a. Cla-Val Co.
   b. Conbraco Industries, Inc.
   c. Spence Engineering Co., Inc.
   d. Watts Industries, Inc.; Water Products Div.

2. Water Hammer Arresters:

   a. Amtrol, Inc.
   b. Enpoco, Inc.
   c. Josam Co.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Co., Inc.
   f. Smith: Jay R. Smith Mfg. Co.
   g. Sparco, Inc.
   h. Tyler Pipe; Wade Div.
   i. Watts Industries, Inc.; Ancon Drain Div.
   j. Watts Industries, Inc.; Water Products Div.
   k. Zurn Industries, Inc.; Hydromechanics Div.

3. Roof Flashing Assemblies:

   a. Elmdor/Stoneman Manufacturing Co.

4. Sleeve Penetration Systems:

   a. ProSet Systems, Inc.

2.2 WATER REGULATORS

A. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig minimum, of size, flow rate, and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y-pattern strainer.

   1. 2-Inch NPS and Smaller: Bronze body with threaded ends.

B. Pilot-operated type.

2.3 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

   1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
   2. 2-Inch NPS and Smaller: Bronze body, with female threaded ends.
   3. 2-1/2-Inch NPS and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved epoxy coating and flanged ends.
   4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
      a. Drain: Factory- or field-installed, hose-end drain valve with permanently affixed chain and cap.

2.4 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI-WH 201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M sizes A through F and PDI-WH 201 sizes A through F.

B. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

   1. Vent Cap: Open top, without cap.

2.5 SLEEVE PENETRATION SYSTEMS

A. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

   1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   2. Stack Fitting: ASTM A 48, cast-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4 lb/sq. ft. or 0.0625-inch thickness.
2. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness.
3. Burning: 6 lb/sq. ft. or 0.0937-inch thickness.

B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 PLUMBING SPECIALTY INSTALLATION

A. General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

B. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.

D. Install hose bibbs with integral or field-installed vacuum breaker.

E. Install wall hydrants with integral or field-installed vacuum breaker.

F. Install cleanouts in aboveground piping and building drain piping as indicated, and where not indicated, according to the following:

1. Size same as drainage piping up to 4-inch NPS. Use 4-inch NPS for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping 4-inch NPS and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

G. Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

H. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

I. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

J. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

K. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.

L. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

1. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
2. Radius, 30 to 60 Inches: Equivalent to one percent slope.
3. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

M. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

N. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

O. Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

P. Secure supplies to supports or substrate.

Q. Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated.

R. Install water-supply stop valves in accessible locations.

S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

T. Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains.

U. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

V. Include steel backing for recessed and wall-mounting plumbing specialties.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing specialties and piping specified in other Division 15 Sections.
2. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
3. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

B. Install hoses between plumbing specialties and appliances as required for connections.

C. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 16 Sections.

D. Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

E. Drainage Runouts to Plumbing Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.

F. Ground electric-powered plumbing specialties.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.3 FLASHING INSTALLATION

A. Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

B. Burn joints of lead sheets where required.

C. Solder joints of copper sheets where required.

D. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in

floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

E. Set flashing on floors and roofs in solid coating of bituminous cement.

F. Secure flashing into sleeve and specialty clamping ring or device.

G. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

H. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

I. Fabricate and install flashing and pans, sumps, and other drainage shapes as required. Install drain connection as required.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

1. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

3.5 COMMISSIONING

A. Before startup, perform the following checks:

1. System tests are complete.
2. Damaged and defective specialties and accessories have been replaced or repaired.
3. Clear space is provided for servicing specialties.

B. Before operating systems, perform the following steps:

1. Close drain valves, hydrants, and hose bibbs.
2. Open general-duty valves to fully open position.
3. Remove and clean strainers.
4. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

C. Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:

1. Energize circuits for electrically operated units. Start and run units through complete

sequence of operations.

D. Adjust operation and correct deficiencies discovered during commissioning.

3.6 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
2. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

3.7 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 each day or when work stops.

END OF SECTION 15425

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SECTION 15440 - PLUMBING FIXTURES

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

A. All pertinent sections of Division 15, Mechanical General Requirements are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

1.2 SCOPE OF WORK:

A. This work shall include all plumbing fixtures, fixture trim specialties, drains, etc., required for the complete plumbing system.

B. A complete domestic cold water system.

C. A complete sanitary drainage.

D. All electrical wiring not specified in other sections but required for a complete operation system, shall be work of this section.

E. Rerouting or capping of any in service or abandoned utility lines unearthed or uncovered by construction.

1.3 CODES AND STANDARDS:

A. All work included in the scope of this specification shall conform to the latest adopted versions of applicable codes and standards, including the following:

International Plumbing Code, 2003 (IPC)
International Building Code, 2003

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.21.1M.
2. Pipe Threads: ASME B1.20.1.

1.5 SUBMITTALS:

A. Submit product data in accordance with Division 1 and Section 15050. Submit the following:

Piping
Valves
Plumbing Fixtures and Accessories
Water Hammer Arrestors
Pressure Reducing Valves
Sterilization Contractor

1.6 TESTS:

A. Piping systems shall be tested as specified in Section 15060.

B. Defective Work: If inspection or tests show defects, such defective work or material shall be replaced or corrected and inspection and tests shall be repeated. All repairs to piping shall be made with new materials. No caulking or screwed joints or holes will be acceptable.

C. All defects in material and workmanship which appear during the test shall be promptly remedied and the test shall be reapplied.

D. Enclosed Piping: Any piping which is to be insulated, placed within the construction, or otherwise concealed shall be carefully tested before being permanently enclosed.

E. Test Instruments: All testing shall be performed in the presence of the Architect and his Mechanical Engineer and shall meet with their approval. Instruments required for making the

tests shall be provided by this Contractor. Relief valves set to avoid excessive pressure during testing shall be provided.

F. Required Adjustments: Before final acceptance of the piping system as a whole, this Contractor shall make all required adjustments, including controls, flush valves, etc., and shall place the entire piping system in a perfect operating condition. At the completion of the work, this Contractor shall furnish the Architect with all certificates of inspection.

1.7 GENERAL REQUIREMENTS:

A. Existing Lines:

1. Any utility line uncovered during construction that is not clearly defined on the drawings shall be immediately brought to the attention of the Architect and Owner. The Owner and Architect will subsequently inform the Contractor what should be done. A change order shall be initiated in accordance with the General Conditions for such occurrences. Relocation of any existing piping shall be done with the same material and fittings as the original installation. Damaged or removed insulation shall be repaired and/or replaced.

B. Vents:

1. The entire system shall be properly vented to atmosphere and all gases shall be discharged at points not less than 14 inches above the roof line. Each fixture shall be back-vented on the discharge side of safe water seal and arranged for free passage of all gases to atmosphere. Vent lines are to be offset, if necessary, so that they will not pierce the roof at points closer than 5 feet 0 inches from the edge of the roof, except where shown otherwise on the drawings.

C. Cleanouts:

1. Full size cleanouts shall be installed at the base of each soil waste or rainwater stack and at the end of each horizontal run of sanitary piping. All other cleanouts shall be installed where shown on the drawings and where required by State, local, or National Plumbing Codes.
2. Cleanouts shall have cast-iron bodies with threaded brass screw plugs. They shall be the full size of the pipe line in which they are installed, up to and including 4 inches. All cleanouts shall be installed in locations easily accessible for rodding. Where stacks or other piping is concealed, cleanouts shall be installed above the floor with extensions made to the finished wall surface. Cleanouts in walls shall be J. R. Smith 4402 with countersunk plugs and round stainless steel access covers. In floors, J. R. Smith 4023 square top cleanouts with countersunk plugs and round scoriated polished nickel bronze access covers with frames shall be used.
3. Cleanouts shall be J. R. Smith, Zurn, Wade, or Josam. J. R. Smith references are used herein.

4. The cleanouts bodies provided in finished floors shall be of the type which allows flooring to be added, i.e. Carpet, Tile or Wood to fit within the manufactured ring and still be flush with the floor.

D. Traps:

1. Each fixture and appliance installed in the work and discharging water into the sewer or house drainage system shall have a seal trap arranged in connection with a complete venting system and shall be installed so that all gases shall pass freely to the atmosphere

with no pressure or siphon condition on the water seal. Each fixture shall have a water seal of not less than (2) inches and not more than (4) inches except where a deeper seal is found necessary by the Administrative Authority for special conditions. Fixtures connected to acid waste piping shall be acid waste type.

E. Flashing and Sleeves:

1. Furnish and install on each pipe passing through the roof a Stoneman Stormtite four pound seamless lead flashing assembly extending horizontally not less than 12-inches all around. Flashing to have steel reinforced conical boot and counter-flashed with a hooded cast iron counter-flashing. Seal the neck of the flashing to the pipe with permaseal waterproofing compound and secure the counter-flashing to the pipe with vandal proof screws. Fill the top annular space of counter-flashing with epoxy compound. Alternate using open top models of all pipes. See specification Section 15100.
2. Sleeves for pipes passing through walls, floors or ceilings shall be as specified in Section 15060.

F. Cleanout Pans:

1. Roof drains, floor drains and cleanouts shall have 4-pound lead sheet pans 30 inches square or as noted. Roof flashing members shall be placed into position but the final installation shall be made by the Roofer under supervision of this section. Floor drains with clamping collars shall be complete with pan. Provide code approved pans for showers.

G. Burying Pipe:

1. Outside pipe placed underground is to be buried a minimum of 4 feet to prevent freezing. All backfill shall be mechanically compacted to meet the density requirements set forth in Division

H. Courses of Water Pipes:

1. Water pipes shall not be exposed in finished rooms except where noted on plans or as permitted by the Architect, except the finished brass supplies that are a part of the fixture trimmings. Pipes are to be run in tunnel, furred ceiling and walls, and behind or under cabinets as shown.

I. Sewer Location:

1. Where the location of the sewer is not clearly defined by dimension on the drawings, it shall not be closer than 10 feet horizontally to a water main or service line, except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, where they shall cross each other at neat 90-degree angles. Verification of existing sewer main elevations shall be made prior to connection or installation of any new lines. Should installation at the minimum required slope be attainable at the connection points shown, the Architect shall be immediately notified before installation of the line possible.

J. Piping Layouts:

1. Layout of piping shown on drawings is in a general sense diagrammatic as to the exact location of piping. It is to be understood by the Contractor that unforeseen conditions and obstacles at the site may not permit the running of piping as scaled from the drawings, but changes shall not be made without the written permission of the Architect. The

Plumbing Contractor shall check toilet room details as shown on the Architectural drawings. He shall check the grade of a waste line with a transit before installing the pipe.

2. See the Plumbing Fixture Schedule and Lab Equipment Schedule on plans for the sizing of connecting lines to each fixture.

K. Floor Drains:

1. Exposed surfaces of floor drains, unless otherwise noted, shall be finished in nickel bronze. Floor waterproofing materials shall be securely anchored in the clamping ring of the floor drain. Floor drain strainers in ceramic tile floors shall be square. The tops of all drains shall be set flush with the finished floor level except where floors are warped to drains, where these shall be set flush. The Contractor shall consult with the trades responsible for adjacent work before establishing final finish elevations. Openings shall be core drilled.

L. Waste and Vent System:

1. A complete plumbing waste and vent system shall be furnished and installed for soil and acid waste. It shall be installed in strict compliance with the International Plumbing Code. It shall be incorporated into the space constraints in the building. Acid wastes shall be kept separate form sanitary soil lines. P-traps on acid waste lines connections shall be of acid waste piping material. Flammable polypropylene waste pipe below slab allowed, non-flammable polypropylene waste pipe above grade. Only heat fused allowed. Mechanical joints not allowed.

M. Connections to Equipment:

1. The Plumbing Contractor shall rough in all utility lines to the cabinets, tables, hoods, and terminate utilities with shutoff valve and waste and vent lines with caps. All such rough-ins shall be labeled. Plumbing contractor shall supply all stops and supply tubing, as well as P-traps to complete the installation. Final connections to be by the Plumbing Contractor.

1.8 EQUIPMENT AND INSTALLATION:

A. Vacuum Breakers:

1. All water outlets with hose ends where backflow is possible and where required by code shall be complete with vacuum breakers. Where vacuum breaker is not specified with fixture trim, the breaker shall be installed in the supply line to the fixture. Vacuum breakers in the supply line shall be Pressure Vacuum breaker by Watts.
2. Atmospheric vacuum breakers shall be of chrome-plated brass, or specified finish, and shall be FEBCO or Watts. Vacuum breaker shall be in accordance with American society of Sanitary Engineers (ASSE) Standard 1011 and shall be capable of being drained if located where freezing is possible.
3. Pressure type vacuum breakers shall be Febco or Watts.

B. Water Hammer Arrestors:

1. J.R. Smith Hydrotrol, Watts, Wade, Zurn, or Precision Plumbing Products, water hammer arresters shall be provided for all quick closing valves in fixture supply lines to eliminate water hammer. Arrestors shall be installed vertically in an accessible location. Shutoff valves shall be installed in lines to all water hammer arrestors.

2. Water hammer arrestors shall comply with Plumbing and Drainage Institute Standard PDI-WH-201.

C. Trap Primers:

1. Trap primers shall be provided serving all floor drains and floor sinks. Trap primers shall be flush valve or lavatory gravity type by Precision Plumbing Products, Jay R. Smith, or MIFAB. Trap primers are not required on shower drains.

1.9 STERILIZATION:

A. After the entire system is completed and tested for pressure, and just before the building is ready to be occupied, this Contractor shall sterilize the system as follows: After the mains are flushed, a water and chlorine solution concentrated to 250 ppm shall be introduced. The treated water and chlorine solution shall be retained for not less than 24 hours. All valves, faucets, etc. shall be opened and closed during this time before final flushing out of the system. Flush system with clean water until the chlorine content is less than 0.2 PPM. The water system will not be accepted until a negative bacteriological test is made on water taken from the systems.

1.10 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2- PRODUCTS:

2.1 MANUFACTURERS

A. List of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in other Part 2 articles.
2. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified in other Part 2 articles.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 PLUMBING FIXTURES:

A. This Contractor shall furnish and install all fixtures shown on the drawings or specified hereinafter, shall make all parts complete, and shall leave the entire system in perfect working order. He shall clean and adjust all fixtures before leaving the job. Any damaged or cracked fixtures shall be replaced at the Contractor's expense.

B. The fixtures shall be all new and complete as shown or described in catalog or as required for the work. The fixtures shall include accessible loose key compression stops above the floor in supplies to all fixtures and cast brass P-traps unless otherwise shown. Trim for all fixtures shall be chrome plated and all trim shall match in design. All exposed piping in occupied spaces shall be chrome plated. Supply faucets shall have renewable seats and barrels.

C. Floor drains shall be furnished with clamping collars where a waterproof membrane is provided. Membranes will be required for all drains installed above occupied spaces. See architectural drawings for additional locations of membranes. Use 40 mil pvc liner or 4# lead.

PART 3 - FIXTURE SCHEDULE

WC-1 Water Closet (Wall Hung) (Flush Valve) (ADA): Kohler #K-4330 "Kingston" vitreous china, 1.6 gal flush, siphon jet, elongated bowl, 1-1/2" top spud, Kohler #K-4670-C open front seat, stainless steel hinge posts with check.Sloan Royal Optima 111 ES-S, 1.6 gallon flush valve with Sloan EL-154 transformer. Smith 0210 horizontal (left or right hand as required) or Smith 0230 vertical adjustable carrier with floor support. See architectural drawings for mounting height. Bemis 1955-C white, solid plastic, open-front seat less cover. See architectural drawings for mounting height.

WC-2 Water Closet (Wall Hung) (Flush Valve): Kohler #K-4330 "Kingston" vitreous china, 1.6 gal flush, siphon jet, elongated bowl, 1-1/2" top spud, Kohler #K-4670-C open front seat, stainless steel hinge posts with check. Sloan Royal Optima 111 ES-S, 1.6 gallon flush valve with Sloan EL-154 transformer. Smith 0210 horizontal (left or right hand as required) or Smith 0230 vertical adjustable carrier with floor support. Bemis 1955-C white, solid plastic, open-front seat less cover. See architectural drawings for mounting height.

U-1 Urinal (Wall Hung, Flush Valve): American Standard Allbrook Urinal, wall hung, vitreous china, 1.0 gallon flush. Extended rim, siphon jet flushing, 3/4" top spud, 2" outlet and wall mounting hanger. Sloan Royal Optima 186-1.0 ES-S, 1.0 gallon flush valve with Sloan EL-154 transformer. See architectural drawings for mounting height.

WS-1 Wash System; Bradley FL-2L Frequency Lavatory System, double station (low on left), solid surface countertop, sensor faucets, 110-120 VAC plug in sensor faucet, thermostatic mixing valve, no soap dispenser, standard color select per architect, trap cover enclosure, steel mounting brackets,

SH-1 Shower: Symmons 1-901-60-56-RS shower system; pressure balancing mixing valve with lever handle, adjustable stop screw to limit handle and push-button operated slow closing supply valve with cycle time adjustment, both valves with screwdriver service stops. Set temperature limit to 105 ^{o}F. Fre-Flo, all brass vandal resistant head with ball joint mounted to institutional type head bracket. Recessed soap dish and sloped metal top cap. 18 gauge Stainless steel covering.

SH-2 Shower (ADA Compliant): Symmons 1-902-FH-60-56-RS shower system with hand spray; pressure balancing mixing valve with lever handle, adjustable stop screw to limit handle and push-button operated slow closing supply valve with cycle time adjustment, both valves with screwdriver service stops. Set temperature limit to 105 ^{o}F. 4-458 Levertrol double outlet diverter with volume control. Fre-Flo, all brass vandal resistant head with ball joint mounted to

institutional type head bracket. Mount upper head at 6'-0" and lower head at 4'-0". Recessed soap dish and sloped metal top cap. 18 gauge Stainless steel covering.

SS-1 Janitor Sink (Floor Mounted, Corner): American Standard Florwell, 28 x 28-inch, enameled cast iron floor-mounted corner model, 7721.038 flat grid drain, 7745-811 removable vinyl-coated rim guard. American Standard 8344.112 service sink faucet with vacuum breaker, screwdriver stops in shanks, 5 foot rubber hose and wall hook.

FD-1 Floor Drain: Smith 2005-A with 6-inch nickel bronze strainer, cast-iron body, 2" outlet and P-trap.

FD-1 Shower Drain: Smith 2005-A with 6-inch nickel bronze strainer, cast-iron body w, 2" outlet and P-trap.

HB-1 Hose Bibb: Watts model HY-430-VB indoor wall hydrant with vacuum breaker, polished chrome plated casing, 3/4" male hose thread outlet, loose key 293-6 and E-27 vacuum breaker.

HY-1 Water Hammer Arrestor: Smith Figure 5020 "Hydrotrol". Rated at 60 F.U. or Smith Figure 5030 "Hydrotrol". Rated at 113 F.U., or Smith Figure 5040 "Hydrotrol". Rated at 154 F.U. and/or Smith Figure 5050 "Hydrotrol". Rated up to 330 F.U. Contractor to install the water hammer arrestor that meets the capacity of the fixture group it serves.

NFH-1 Wall Hydrant: Watts HY-420 with integral vacuum breaker, (non-freeze) chrome finish, 12" minimum length, 18" if possible. Provide shutoff valve in supply pipe to each NFH-1. Valve to be located in accessible location, typically in ceiling space. Locate valve as close to NFH-1 as feasible for accessibility.

END OF SECTION 15440

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SECTION 15462 - FUEL-FIRED WATER HEATERS

1PART - 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. Gas water heaters.

B. Related Section: Division 15 Section "Plumbing Specialties" contains requirements that relate to this Section.

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 including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories. Indicate dimensions, finishes and coatings, required clearances, methods of assembly of components, and piping and wiring connections.

C. Shop Drawings showing layout of each unit, including tanks, pumps, controls, related accessories, and piping.

D. Setting Drawings with templates and directions for installing foundation bolts, anchor bolts, and other anchorages.

E. Wiring diagrams from manufacturers detailing electrical requirements for electrical power supply wiring to water heaters. Include ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between factory-installed and field-installed wiring.

F. Product certificates signed by manufacturers of water heaters certifying that their products comply with specified requirements.

G. Certificates of shop inspection and data report as required by provisions of ASME Boiler and Pressure Vessel Code, when ASME construction is indicated.

H. Field quality-control installation reports.

I. Maintenance data for water heaters to include in operation and maintenance manuals specified in Division 1. Include startup instructions.

1.4 QUALITY ASSURANCE

A. AGA Standards: Comply with AGA standards and bear AGA certification label.

B. ASHRAE Standard: Comply with performance efficiencies prescribed in ASHRAE 90.1, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings."

C. ASHRAE Standard: Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

D. NFPA Standard: Comply with NFPA 70, "National Electrical Code," for electrical components.

E. Listing and Labeling: Provide electrically operated water heater controls and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

F. Product Options: Drawings indicate size, profiles, connections, dimensional requirements, and characteristics of water heaters and accessories and are based on specific types and models indicated. Other manufacturers' water heaters and accessories with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1.5 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

2PART - 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. Storage, Gas Water Heaters:

a. American Water Heater Group.
b. Bradford White Corp.
c. Lochinvar Corp.

d. Rheem Mfg. Co.;
e. A.O. Smith Co.
f. State Industries, Inc.
g. PVI Industries, Inc.
h. State Industries, Inc.

2. Compression Tanks:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Expanflex, Inc.
d. Smith: A.O. Smith; Aqua-Air Div.
e. State Industries, Inc.

2.2 WATER HEATERS, GENERAL

A. Specified manufacturer's standard components and features are acceptable where specific product requirements are not indicated.

B. Temperature Control: Adjustable thermostat, except for units where other arrangement is indicated or temperature is regulated by flow-control fitting.

C. Safety Control: Automatic, high-temperature-limit cutoff device or system on commercial units and where indicated. Include automatic low-water cutoff device or system on commercial units where indicated.

D. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

E. Tappings: Factory fabricated of materials compatible with tank. Include tappings for piping connections, relief valves, pressure gage, thermometer, blow down, vent, and controls as required and others as indicated. Attach tappings to tank before testing and labeling. Include tappings and connections as follows:

1. 2-Inch NPS and Smaller: Threaded ends.
2. 2-1/2-Inch NPS and Larger: Flanged ends.

F. Insulation: Fiberglass, polyurethane foam, or manufacturer's standard that is suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.

G. Jacket: Steel, with baked-on enamel finish, except where otherwise specified.

H. Anode Rods: Factory installed, magnesium.

2.3 STORAGE, GAS WATER HEATERS

A. Description: ANSI Z21.10.1, storage, gas water heater; with capacity more than 40 gal.

B. Storage Tank Construction: Steel with 150-psig working-pressure rating and manufacturer's standard lining.

C. Burner: Manufacturer's standard atmospheric, for natural-gas fuel.

D. Gas Shutoff Valve: ANSI Z21.15, manually operated. Furnish for installation in piping.

E. Pressure Regulator: ANSI Z21.18, factory or field installed, for gas appliances. Provide regulators with pressure rating, capacity, and pressure differential required for water heater and gas supply.

F. Automatic Ignition: ANSI Z21.20, automatic gas-ignition system and components.

G. Automatic Valve: ANSI Z21.21, appliance, automatic gas valve.

H. Automatic Damper: ANSI Z21.66, gas-fired-appliance, automatic-vent-damper device.

I. Draft Hood: Manufacturer's standard, low-profile-type, draft diverter; comply with ANSI Z21.12.

J. Heat Traps: Manufactured, factory- or field-installed, cold-type inlet fitting in inlet and hot-type outlet fitting in outlet of household water heater.

K. Drain Valve: ASSE 1005, factory or field installed. Omit when water heater is without drain outlet and include general-duty drain valve in piping.

L. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 and ANSI Z21.22. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

M. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping.

2.4 COMPRESSION TANKS

A. Description: Steel, pressured-rated tanks constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

B. Construction: 150-psig working-pressure rating.

C. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

D. Accessories: Include air-charging valve and pressure gage.

3PART - EXECUTION

3.1 WATER HEATER INSTALLATION

A. General: Install water heaters on concrete bases. Set and connect units according to manufacturer's written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturer's recommended clearances. Install so controls and devices are accessible for service.

B. Install seismic restraints as indicated.

C. Install and connect gas water heaters according to NFPA 54.

1. Install gas pressure regulators on gas-burner inlets.
2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brass-screened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.

D. Install temperature and pressure relief valves in top portion of storage water heater tanks and hot-water storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for drain valves.

F. Install thermometers on water heater inlet and outlet piping. Thermometers are specified in Division 15 Section "Meters and Gages."

G. Install pressure gages on water heater piping when and as indicated. Pressure gages are specified in Division 15 Section "Meters and Gages."

H. Install inlet and outlet piping manifolds for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through water heaters. Include throttling valves in outlet manifolds and thermometers in inlet and outlet manifolds.

I. Install piping adjacent to water heaters to allow service and maintenance.

J. Arrange for field-applied insulation on equipment and piping not furnished with factory-applied insulation.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Connect hot- and cold-water piping to units with shutoff valves and unions.
2. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.
3. Make connections with dielectric fittings where piping is made of dissimilar metals. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Gas, Water Heater Vent Connections: Connect to vent system. Include draft hoods and diverters where required. Use vents same size as or larger than water heater outlets, but not smaller than indicated, except when smaller vent size has been calculated according to National Fuel Gas Code. Comply with gas utility requirements for sizing. Gas vents are specified in Division 15 Section "Breechings, Chimneys, and Stacks."

3.3 COMMISSIONING

A. Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

1. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

B. Perform the following final checks before startup:

1. Fill water heaters with water.
2. Charge compression tanks with air.
3. Check that piping system tests are complete.
4. Check for piping connection leaks.
5. Check for adequate combustion air.
6. Check for clear vents and devices.
7. Check for clear relief valve inlets, outlets, and drain piping.
8. Check operation of pumps and circulators.
9. Test operation of safety controls, relief valves, and devices.

C. Perform the following startup procedures:

1. Adjust operating controls.
2. Adjust hot-water-outlet temperature settings.

END OF SECTION 15462

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SECTION 15511 - RADIANT HEATING PIPING

1 PART - 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 radiant heating piping, including pipes, fittings, special-duty valves, and piping specialties.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through basement walls, and fire and smoke barriers.
2. Division 15 Section "Basic Mechanical Materials and Methods" for general piping connections and connection methods.
3. Division 15 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves applicable to this Section.
4. Division 15 Section "Mechanical Identification" for labeling and identifying radiant heating piping.
5. Division 15 Section "Hydronic Piping" for pipes and connections to hydronic systems.
6. Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing radiant heating piping.

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 radiant heating piping specialty and special-duty valve specified, including rated capacities of selected models and installation instructions.

C. Shop Drawings showing piping layout and types of valves, manifolds, and controls, anchorage details, conditions requiring accessories, and other specialties.

D. Coordination Drawings, including floor plans and sections drawn to scale. Submit with Shop Drawings. Show tubing layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

E. Maintenance data for each specialty and special-duty valve specified to include in the operation and maintenance manual specified in Division 1.

1.4 COORDINATION

A. Coordinate layout and installation of piping with building and structural components.

B. Coordinate size and location of access panels to allow entry to manifolds concealed in ceilings, walls, and floors.

C. Coordinate thickening of slabs where required for adequate encasement of radiant heating piping components.

D. Revise locations and elevations from those indicated as required to suit field conditions and assure integrity of piping and as approved by Architect.

2 PART - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Plastic Ball Valves:

   a. Heatlink USA Inc.

2. Distribution Manifolds:

   a. Heatlink USA Inc.
   b. Heatway, Inc.
   c. Hume Snow Melting Systems, Inc.
   d. Infloor Canada Inc.
   e. Rehau Inc.
   f. Vanguard Plastics, Inc.
   g. Wirsbo Co.

3. Mixing Valves:

   a. Heatlink USA Inc.

4. Controls:

   a. Heatlink USA Inc.
   b. Hume Snow Melting Systems, Inc.
   c. Infloor Canada Inc.
   d. Tekmar Control Systems Ltd.
   e. Wirsbo Co.

5. Thermostats:

   a. Heatlink USA Inc.
   b. Tekmar Control Systems Ltd.
   c. Wirsbo Co.

2.2 PIPES AND TUBES

A. Crosslinked Polyethylene (PEX) Plastic: ASTM F 876 or ASTM F 877 for service at 100 psig and 180 deg F.

B. Crosslinked Polyethylene (PEX) Plastic: ASTM F 876 or ASTM F 877 for service at 80 psig and 200 deg F.

   1. Fittings: Copper or brass compression type.

2.3 PIPING SPECIALTIES

A. Base Elements: Polystyrene plastic sheet with formed pipe channels or clips.

B. Pipe Tracks: Molded plastic with pipe supports permitting pipe spacing at 2-inch intervals.

C. Track Staples: Staple with hooks for fastening to polystyrene plastic.

D. Tie Straps: Nylon.

E. Heat-Transfer Plates: Formed metal.

F. Conduit Elbows: High-impact molded plastic, internal diameter sized for piping.

G. Expansion Stripping: Flexible joint to protect wall from concrete, allow expansion, and reduce sound transmission.

2.4 SPECIAL-DUTY VALVES

A. Plastic Ball Valves: 87 psig cold working pressure (CWP), 160 deg F maximum operating temperature, full port design, chlorinated polyvinyl chloride (CPVC) body and ball, PTFE seats, EPDM seals, tee handle; threaded, socket, or union connections.

2.5 RADIANT HEATING SPECIALTIES

A. Distribution Manifolds: Welded steel; enameled; with 3-way mixing valve, main shutoff and balancing valves with thermometers, zone shutoff and balancing valves with flow meter, and identification plate.

   1. Mixing Valves: 87 psig CWP, 160 deg F maximum operating temperature, CPVC or cast-bronze body, EPDM seals, threaded connections, 3 or 4 way as noted.
   2. Circulation Pump: Bronze fitted or stainless steel, in-line mounted on manifold.

B. Controls: Modular controller allows control of loop valves by space thermostats, with connections for pump relay; with 24-V, 40-A transformer.

   1. Thermostats: Standard 24 V, 3 wire.
   2. Thermostats: 3 position, 24 V, 5 wire, for day and night setback and clock program.

3. Indoor/Outdoor: Controller regulates supply water temperature through 3- or 4-way valve, as a function of supply water temperature and outdoor temperature; 24 V.
4. Snow/Ice Melting: Microprocessor-based control regulates mixing valve, in response to snow/ice sensor and heat output rate, with maximum supply and minimum return temperature limits, 24 V.

    a. Snow/Ice Detector Sensor: Solid-state sensor measuring temperature and detecting water, for installation in heated slab.
    b. Snow/Ice Slab Sensor: Solid-state sensor measuring temperature, for installation in heated slab.

C. Access Panels: Refer to Division 8 Section "Access Doors" for access panels installed in ceilings, walls, and floors to gain entry to concealed manifolds.

3 PART - EXECUTION

3.1 INSTALLATION

A. Install piping and equipment as indicated, according to manufacturer's written instructions.

B. Run piping from manifolds without joints.

C. Install piping in concrete floor topping using pipe tracks.

D. Provide conduit elbows where pipes penetrate concrete flooring.

E. Identify room served and loop number, when more than one loop serves one room, on manifold with identification tags provided with manifold.

F. Fill system with 30 percent glycol/water solution.

3.2 FIELD QUALITY CONTROL

A. Testing Preparation: Prepare piping as follows:

1. Flush with clean water. Clean strainers.
2. Isolate equipment not subjected to test pressure.
3. Install relief valve set at a pressure no more than one-third higher than test pressure.

B. Testing: Test piping as follows:

1. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
2. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
3. Prepare written report of testing.

3.3 CLEANING

A. Clean and flush piping. Remove, clean, and replace strainer screens. After cleaning and flushing the piping, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

3.4 COMMISSIONING

A. Fill system and perform initial chemical treatment.

B. Check expansion tanks to determine that they are not air bound and that system is completely full of water.

C. Perform these steps before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Remove and clean strainers.
3. Set automatic fill valves for required system pressure.
4. Check air vents and determine if all are operating freely (automatic type) or bleed air completely (manual type).
5. Check operation of automatic valves.

END OF SECTION 15511

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SECTION 15514 - FINNED WATER-TUBE BOILERS

1 PART - 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 gas-fired, finned water-tube boilers for heating hot water.

B. Related Sections include the following:

1. Division 15 Section "Chemical Water Treatment" for feedwater treatment and connections.
2. Division 15 Section "Breechings, Chimneys, and Stacks" for connections to breechings, chimneys, and stacks.

1.3 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. ASME Compliance: Boilers shall bear ASME "H" stamp and be National-Board listed.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.6 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.

1. Warranty Period: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

2 PART - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide boilers by one of the following:

1. Patterson-Kelley Co.
2. Lochinvar Corp.
3. Raypak, Inc.
4. Rheem/Ruud Water Heater.
5. Smith: A.O. Smith Water Products Co.
6. Teledyne, Inc; Teledyne Laars, Div.
7. Weben-Jarco, Inc.

2.2 COMPONENTS

A. Combustion Chamber Internal Insulation: Interlocking panels of vermiculite refractory insulation, high-temperature cements, mineral fiber, and refractory clay for service temperatures to 2100 deg F.

B. Heat Exchanger: Finned copper tubing with stainless-steel baffles and sealed into bronze, steel, or cast-iron headers with silicone O-ring gaskets; for 160-psig working pressure.

C. Jacket: Galvanized steel with factory-applied baked enamel, insulated with foil-faced, glass fiber insulation.

D. Gas Burner: Stainless-steel burners with adjustable combustion-air supply, gas-pressure regulator, diaphragm gas valves, manual shutoff, thermistor flame-sensing device, and automatic 100 percent safety gas shutoff. Include the following features:

SELECT ONE FROM EACH GROUP BELOW.

1. Burner Firing: Modulating.
2. Burner Ignition: Intermittent spark or glow coil.
3. Safety Controls: Energize ignition, limit time for establishing flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, and allow gas valve to open.
4. Flue-Gas Collector: Enclosed combustion chamber with integral combustion-air blower and single venting connection.

2.3 BOILER TRIM

A. Safety-Relief Valve: ASME rated, factory set to protect boiler and piping.

B. Gage: Combination water pressure and temperature.

C. Low-Water Cutoff and Inlet Flow Switch: Prevent burner operation when water falls below a safe level or when water flow is low.

D. Operating Controls: Prewired, factory-assembled electric control including pilot safety and thermocouple transformer, 24-V gas valve, manual main and pilot valves, and junction box.

E. Operating Temperature Control: Electric indoor/outdoor controller maintains boiler water temperature with outdoor temperature reset.

F. High Limit: Temperature control with automatic-reset limits boiler water temperature.

G. Boiler air vent.

2.4 MOTORS

A. Refer to Division 15 Section "Motors" for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

C. Enclosure Type: Open dripproof motors where satisfactorily housed or remotely located during operation.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect boilers according to the ASME Boiler and Pressure Vessel Code, Section IV.

3 PART - EXECUTION

3.1 EXAMINATION

A. Examine area to receive boiler for compliance with requirements for installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install boilers level and plumb, according to manufacturer's written instructions and referenced standards.

B. Install gas-fired boilers according to NFPA 54.

C. Support boilers on 4-inch- thick concrete base, 4 inches larger on each side than base of unit.

D. Install electrical devices furnished with boiler, but not specified to be factory mounted.

3.3 CONNECTIONS

A. Connect gas piping full size to boiler gas-train inlet with union.

B. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

C. Install piping from safety-relief valves to nearest floor drain.

D. Connect breeching to boiler outlet, full size of outlet.

E. Electrical: Comply with applicable requirements in Division 16 Sections.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly of components and installation of boilers, including piping and electrical connections. Report results in writing.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Hydrostatically test assembled boiler and piping, according to applicable sections of the ASME Boiler and Pressure Vessel Code.

3.5 CLEANING

A. Flush and clean boilers on completion of installation, according to manufacturer's written instructions.

B. After completing boiler installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions with manufacturer's touchup paint.

3.6 COMMISSIONING

A. Engage a factory-authorized service representative to provide startup service.

B. Verify that installation is as indicated and specified.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.

C. Complete manufacturer's installation and startup checklist and verify the following:

1. Boiler is level on concrete base.
2. Flue and chimney are installed without visible damage.
3. No damage is visible to boiler jacket, refractory, or combustion chamber.
4. Pressure-reducing valves are checked for correct operation and specified relief pressure. Adjust as required.
5. Clearances have been provided and piping is flanged for easy removal and servicing.
6. Heating circuit pipes have been connected to correct ports.
7. Labels are clearly visible.
8. Boiler, burner, and flue are clean and free of construction debris.
9. Pressure and temperature gages are installed.
10. Control installations are completed.

D. Ensure pumps operate properly.

E. Check operation of pressure-reducing valve on gas train, including venting.

F. Check that fluid-level, flow-switch, and high-temperature interlocks are in place.

G. Start pumps and boilers, and adjust burners to maximum operating efficiency.

1. Fill out startup checklist and attach copy with Contractor Startup Report.
2. Check and record performance of factory-provided boiler protection devices and firing sequences.
3. Check and record performance of boiler fluid-level, flow-switch, and high-temperature interlocks.
4. Run-in boilers as recommended or required by manufacturer.

H. Perform the following tests for each firing rate for high/low burners and for 100, 66, and 33 percent load for modulating burners. Adjust boiler combustion efficiency at each firing rate. Measure and record the following:

1. Gas pressure on manifold.
2. Combustion-air temperature at inlet to burner.
3. Flue-gas temperature at boiler discharge.
4. Flue-gas carbon-dioxide and oxygen concentration.
5. Natural flue draft.

I. Measure and record water flow rate, pressure drops, and temperature rise through each boiler.

J. Inspect expansion tank, makeup water meter, tank pressure, pressure-reducing valve, water level, and backflow preventer.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Operate boiler, including accessories and controls, to demonstrate compliance with requirements.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 15514

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SECTION 15545 - CHEMICAL WATER TREATMENT

1 PART - 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 water-treatment systems for the following:

1. Hot-water heating systems.

1.3 SYSTEM DESCRIPTION

A. Closed System: One bypass feeder on each system, with isolating and drain valves installed around balancing valve downstream of circulating pumps, unless otherwise indicated.

1. Introduce closed system treatment through bypass feeder when required or indicated by test.

a. Performance: Water treatment sized and equipped to treat raw water available at Project.

Water characteristics will change with location and type of treatment - usually the treatment parameters will be left to the water treatment supplier based on the type of treatment specified.

2. Closed Circulating Water Systems:

a. Chemicals:

1) PECO 5483 Liquid Cleaner
2) PECO 8410 non-Chromate, Corate-Nitrate corrosion inhibitor

b. Equipment: (To be mounted as per drawings)

1) One (1) Neptune VTF5 bypass feeder for each system.
2) One (1) Carton water meter model JSJ750 to be installed in the make-up water line of each closed system.

c. Cleaning: Cleaning shall be performed by the contractor under the supervision of the chemical supplier at the time of start up. The system shall be filled with water

and checked for leakage and debris. Add the proper dosage of 5483 liquid cleaner and circulate for 24 hours at required temperature. Drain and flush piping, clean the strainers. Flush until system pH is no more than eight.

d. Control: The contractor shall provide a PECO Nitrite drop test kit for checking the concentration of 8410 in the system.

e. Service: The contractor shall provide initial and continuing field service to fulfill the requirements and objectives of the General Water Treatment Specifications.

B. Closed Loop Glycol Feed Systems:

2. Glycol: The glycol provided shall be ethylene glycol as manufactured by Dow Chemical. Trade name shall be Dowtherm SR-1. The water quality in the preheat glycol water system shall meet the recommendations of the glycol manufacturer so as to reduce sludging. Glycol percentage shall be 40% unless noted otherwise on the drawings. by volume.

EQUIPMENT:

PER EACH SYSTEM

One (1) 50 gallon polyethylene feed tank. Tank shall be mounted on a steel frame with accommodations for mounting a pump underneath. Tank shall be supplied with a hinged lid and all interconnecting piping to pump including strainer.

One (1) Level switch to deactivate pump and activate alarm on low level.

One (1) Control panel to house switching device for pump, audible alarm, HOA switch for pump, lights to indicate power and low level, pushbutton for alarm silence. Enclosure shall be NEMA 12. Control panel shall be mounted on the tank stand.

One (1) 1/3 HP rotary gear pump to be mounted under the feed tank. Materials of construction shall be bronze. Pump shall provide 3 GPM at 60 PSIG.

One (1) ASCO Solenoid valve 1/2" to be mounted in the feed line to the hot/chilled system. The valve shall be activated at the same time as the pump.

One (1) Mercoid pressure switch set at 50 (adjustable) PSIG to activate the glycol feed pump. Differential setting for the pressure switch shall be 10 (adjustable) PSI.

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 for each type of product specified. Include manufacturer's technical product data, rated capacities of selected equipment clearly indicated, water-pressure drops, weights (shipping, installed, and operating), furnished specialties, accessories, and installation and startup instructions.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

D. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.

E. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

F. Maintenance data for chemical water treatment to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions and parts list for each item of equipment, control, and accessory. Include troubleshooting maintenance guide.

1.5 QUALITY ASSURANCE

A. Supplier Qualifications: A recognized chemical water treatment supplier with warehousing facilities in the Project's vicinity and that is or employs an experienced consultant, available at reasonable times during the course of the Work to consult with Contractor, Architect, and Owner about water treatment.

B. Chemical Standards: Meet state and local pollution-control regulations.

C. Comply with NFPA 70 for components and installation.

D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.6 MAINTENANCE

A. Service Period: Provide chemicals and service program for period of one year from startup date of equipment, including the following:

1. Initial water analysis and recommendations.
2. Startup assistance.
3. Training of operating personnel.
4. Periodic field service and consultation.
5. Customer report charts and log sheets.
6. Laboratory technical assistance.

2 PART - 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:

1. Chemical Water Treatment Products:

a. Nalco Chemical Co.
b. Power Engineering Co.

2.2 CHEMICAL WATER TREATMENT SYSTEM

A. Bypass (Pot) Feeders: Cast iron or steel, for introducing chemicals into system; with funnel, shutoff valve on top, air release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.

1. Capacity: 5 gal.

B. Positive Displacement Diaphragm Pump: Adjustable flow rate; thermoplastic construction; continuous-duty, fully enclosed electric motor and drive; and built-in relief valve.

C. Chemical Solution Tanks: (optional - only required on Steam Systems) Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings; with molded fiberglass cover with recess for mounting pump, agitator, or liquid-level switch.

1. Capacity: 50 gal..

D. Agitator: (optional - only required on Steam Systems) Fully enclosed electric motor, stainless-steel clamp and motor mount, with Type 316 stainless-steel shaft and propeller.

E. Liquid-Level Switch: (optional - only required on Steam Systems) Polypropylene housing, integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level alarm.

F. Packaged Conductivity Controller: Solid-state circuiting, 5 percent accuracy, linear dial adjustment, built-in calibration switch, ON-OFF switch and light, control function light, output to control circuit, and recorder.

G. Cold-Water Meter: Positive displacement type with sealed, tamperproof magnetic drive; impulse contact register; single-pole, double-throw, dry-contact switch.

H. Solenoid Valves: Forged-brass body, globe pattern, normally open or closed as required, general-purpose solenoid enclosure, and continuous-duty coil.

I. Electronic Timers: Infinitely adjustable over full range, 150-second and 5-minute range, mounted together in cabinet with HAND-OFF-AUTOMATIC switches and status lights.

J. Condenser Water Treatment Control Panel: Incorporate solid-state integrated circuits and digital LED displays, in NEMA 250, Type 12 steel enclosure. Provide gasketed and lockable door.

1. Control dissolved solids on conductivity and include the following:

   a. LED digital readout display (microhm/cm).
   b. Temperature-compensated sensor probe adaptable to sample stream manifold.
   c. HIGH, LOW, and NORMAL conductance indicator lights (LED).
   d. HIGH or LOW conductance alarm light, trip points field adjustable; with SILENCE switch.
   e. HAND-OFF-AUTOMATIC switch for solenoid bleed valve.
   f. BLEED light to indicate valve operation.
   g. Adjustable hysteresis or dead-band (internal).

2. Control inhibitor feed on makeup volume and include the following:

   a. Solid-state reset counter (1 to 15, selectable).
   b. Solid-state timer (adjustable 1/4 to 5 minutes).
   c. Test switch.
   d. HAND-OFF-AUTOMATIC switch for chemical pump.
   e. Illuminated legend shall indicate FEED when pump is activated.
   f. Solid-state lockout timer (adjustable 1/4 to 3 hours) and indicator light. Lockout timer shall deactivate the pump and activate alarm circuits.
   g. Panel totalizer (amount of makeup), electromechanical type.

3. Biocide programmer to include the following:

   a. 24-hour timer with 14-day skip feature to permit activation any hour of the day.
   b. Precision, solid-state, bleed-lockout timer (0 to 9 hours) and biocide pump timer (0 to 2.5 hours), clock controlled.
   c. Solid-state alternator to enable the use of 2 different formulations.
   d. Digital display of time of day (24 hours).
   e. LED display of day of week (14 days).
   f. Fast and slow clock set controls (internal).
   g. Battery back-up so clock is not disturbed by power outages; quartz timekeeping accuracy.
   h. HAND-OFF-AUTOMATIC switches for biocide pumps.
   i. BIOCIDE A and BIOCIDE B illuminated legends indicate pump running.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Cabinet: White-enamel cabinet with local fluorescent light, capable of accommodating 4- to 10-mL, zeroing, titrating burettes and associated reagents.

B. Kits: As recommended by water treatment system manufacturer for determining water hardness and water characteristics, including carrying case and spare reagents.

2.4 CHEMICALS

A. Furnish chemicals recommended by water treatment system manufacturer for treating water to meet specified water quality. Provide only chemicals that are compatible with piping materials, seals, and accessories.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed System (Water) Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

3 PART - EXECUTION

3.1 INSTALLATION

A. Install treatment equipment level and plumb, according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. The Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping adjacent to equipment to allow servicing and maintenance.
2. Hot Water Piping: Conform to applicable requirements of Division 15 Section "Hydronic Piping."
3. Steam Piping: Conform to applicable requirements of Division 15 Section "Steam and Condensate Piping."

B. Electrical: Conform to applicable requirements of Division 16 Sections for connecting electrical equipment.

1. Install electrical devices furnished with boiler but not specified to be factory mounted.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris; repair damaged finishes, including chips, scratches, and abrasions.

B. Ensure that system is operational, filled, started, and vented prior to cleaning. Place terminal control valves in OPEN position during cleaning. Use water meter to record capacity in each system.

C. Add cleaning chemicals as recommended by manufacturer.

1. Hot-Water Heating System: Apply heat while circulating, slowly raising system to design temperature; maintain for a minimum of 12 hours. Remove heat and allow to cool; drain and refill with clean water. Circulate for 6 hours at design

temperature, then drain. Refill with clean water and repeat until system cleaner is removed.

2. Chilled-Water System: Circulate for 48 hours, then drain. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
3. Steam System: Fill steam boilers only with cleaner and water. Apply heat and maintain for a minimum of 12 hours. Cool and drain. Refill with clean water, drain, refill, and check for sludge. Repeat until system is free of sludge. Apply heat to produce steam for piping system and maintain for a minimum of 8 hours. Bypass traps and waste condensate.
4. Open System: Flush with clean water for a minimum of one hour. Drain completely and refill.

3.4 COMMISSIONING

A. Startup Services: Provide the services of a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Startup Procedures: During boiler system startup, operate boiler water treatment system (after charging with specified chemicals) to maintain required steady-state characteristics of feedwater.

3.5 DEMONSTRATION

A. Provide services of supplier's technical representative for half a day to instruct Owner's personnel in operation, maintenance, and testing procedures of boiler water treatment system.

B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

C. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."

D. Schedule training with Owner, through the Architect, with at least 7 days' advance notice.

END OF SECTION 15545

SECTION 15550 - BREECHINGS, CHIMNEYS, AND STACKS

1 PART - 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. Type B gas vents.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Shop Drawings: Show fabrication and installation details for breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other Work. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, hangers and seismic restraints, and location and size of each field connection.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing refractory-lined stacks similar to those indicated for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain Type B vent system components through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Comply with AWS D1.1 for welder qualifications, welding details, and workmanship standards.

E. Comply with SMACNA's "Guide for Steel Stack Design and Construction."

F. Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabricated breechings.

2 PART - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Type B Gas Vents:

a. American Metal Products; a Masco Company.
b. General Products Co.; Air-Jet Div.
c. Hart & Cooley, Inc.
d. Selkirk Metalbestos.
e. Simpson Dura-Vent Co., Inc.
f. United McGill Corp.; Airflow Group.
g. Van-Packer Co.

2.2 TYPE B GAS VENTS

A. Description: Double-wall gas vents complying with NFPA 211, Type B. Inner pipe of sheet aluminum, outer pipe of galvanized-steel sheet, each with the following minimum thicknesses:

1. Round, 6-Inch and Smaller ID: 0.012-inch inner pipe, 0.0187-inch outer pipe.

B. Accessories: Tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, firestop spacers, and fasteners; fabricated of similar materials and designs as vent-pipe straight sections.

3 PART - EXECUTION

3.1 INSTALLATION OF MANUFACTURED BREECHINGS, CHIMNEYS, AND STACKS

A. Install according to manufacturer's written instructions. Locate to comply with minimum clearances from combustibles.

B. Install, support, and restrain according to requirements of seismic zone.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by the manufacturer to support weight of vent and all accessories, without exceeding loading of appliances.

1. Where maximum unsupported lengths of stack are exceeded, support chimneys as follows:

a. Guy wires.
b. Rigid pipe braces.
c. Rigid angle-iron braces.

3.2 INSTALLATION OF FABRICATED BREECHINGS

A. Install concrete inserts in formwork to support breeching independent of its appliance connection.

B. Assemble and erect fabricated breechings according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Install, support, and restrain according to requirements of seismic zone.

D. Align breechings at connections, with smooth internal surface and 1/8-inch misalignment tolerance.

E. Slope breechings down to appliance, with condensate drain connection at lowest point piped to nearest drain.

F. Install accessories, dampers, fans, equipment, controls, and other supports.

G. Anchor breechings to building structure with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or special beam clamps.

H. Support vertical stacks at 12-foot intervals by attaching to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.

1. 24 by 20 Inches and Smaller: Use straps or formed angles 1-1/2 by 0.0598 inch.
2. Larger Than 24 by 20 Inches: Use steel angle brackets 1 by 1/8 inch for sizes 36 by 18 inches or smaller; 1-1/2 by 1/8 inch for larger sizes.

I. Support horizontal breechings located against structural walls and other similar adjacent vertical surfaces at 96-inch intervals for units with horizontal dimensions of 40 inches and smaller, and at 48-inch intervals for larger breechings.

1. Where Width Is Less Than Height: With straps 1-1/2 by 0.0598 inch.
2. Where Width Is More Than Height: With shelf-type fabricated angle brackets; 1 by 1/8 inch for widths 18 inches and smaller; 1-1/2 by 1/8 inch for larger widths.

J. Support horizontal rectangular breechings from overhead structure with bolted hangers at 120-inch intervals for unit widths 60 inches and smaller, and 96-inch intervals for larger breechings.

1. Breechings 60 Inches and Smaller in Width: Straps 1 by 0.0598 inch.
2. Breechings 61 to 96 Inches in Width: Straps 1-1/2 by 0.1046 inch.

K. Trapeze Hangers: Support breechings with horizontal angles and vertical supports according to the following long-side dimensions:

1. 30-Inch and Smaller Size: 1-by-1/8-inch angle, with 1-by-0.0478-inch- or 1/4-inch-diameter hangers.
2. 31- to 60-Inch Size: 1-1/2-by-1/8-inch angle, with 1-1/2-by-0.0598-inch- or 3/8-inch-diameter hangers.
3. 61- to 84-Inch Size: 2-by-1/8-inch angle, with 1-1/2-by-0.0747-inch- or 1/2-inch- diameter hangers.
4. Larger Than 84-Inch Size: 2-by-1/4-inch angle, with 5/8-inch- diameter hangers, unless otherwise indicated.

L. Support horizontal round breechings with girth strap and strap hanger (of same size). Install pair of strap hangers bolted to opposite sides of angle reinforcing rings or flanged joints. Support breechings at 120-inch intervals with hangers as follows for corresponding diameters:

1. 30 Inch and Smaller Diameter: Strap hangers 1 by 0.0598 inch.
2. 31- to 50-Inch Diameter: Strap hangers 1-1/2 by 0.0598 inch.
3. 51- to 84-Inch Diameter: Pairs of strap hangers 1-1/2 by 0.0598 inch.

3.3 INSTALLATION OF DAMPERS

A. Install barometric and thermostatically operated dampers according to manufacturer's written instructions. Locate as close to draft hood collar as possible.

3.4 CLEANING

A. After completing system installation, including terminals, inspect exposed finishes. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean breechings internally, during and on completion of installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

C. Provide temporary closures at ends of breechings and chimneys that are not completed or connected to equipment.

END OF SECTION 15550

SECTION 15815 - METAL DUCTS

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 rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems.

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and - distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Product Data: For duct liner and sealing materials.

B. Coordinate Shop Drawings: Provide scaled (1/4" = 1'-0") drawing for all ductwork showing details of the following 1.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating pressure classifications and sizes on plans.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint construction.
6. Penetrations through fire-rated and other partitions.
7. Terminal unit, coil, and humidifier installations.

8. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.
9. Ceiling suspension assembly members.
10. Other systems installed in same space as ducts.
11. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
12. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

B. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

E. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

C. All ductwork lined or bare shall be protected from corrosion and contamination caused by moisture and dirt. All ductwork and openings tobe protected with reinforced plastic sheating until assembled in place. All open ends of ductwork to be covered.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

C. Stainless Steel: ASTM A 480/A 480M, Type 304, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

D. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form with standard, one-side bright finish for ducts exposed to view and with mill finish for concealed ducts.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

1 Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, cast in place inserts, or structural-steel fasteners appropriate for building materials.

B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.5 DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Static-Pressure Classification: Unless otherwise indicated, construct ducts to the following:

1. Exhaust duct: 2-inch wg, negative

C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

2.7 ROUND AND FLAT-OVAL DUCT FABRICATION

A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.

B. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.

D. Install ducts with fewest possible joints.

E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct.

G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition 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 metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire and smoke damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Where ducts pass through interior partitions and exterior walls,

C. Pressure Classification Less Than 2-Inch wg: Transverse joints.

D. Seal externally insulated ducts before insulation installation.

E. Seal all seams and joints of shower room exhaust duct work water tight with silicone. Slope duct down to exhaust grille.

3.3 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Support vertical ducts at a maximum interval of 8 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install concrete inserts before placing concrete.

F. Install vertical and horizontal supports for ductwork located on the roof and other structures. The support is to be per SMACNA's supporting standards. Supports are to be for lateral and longitudinal.

3.4 CONNECTIONS

A. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.

D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.

E. Remake leaking joints and retest until leakage is less than maximum allowable.

F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.6 ADJUSTING

A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.

B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.7 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 15815

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SECTION 15820 - DUCT 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. Backdraft dampers.
2. Manual-volume dampers.
3. Turning vanes.
4. Duct-mounted access doors and panels.
5. Flexible connectors.
6. Duct accessory hardware.
7. High efficiency take-offs.
8. Concealed damper regulators.

B. Related Sections include the following:

1. Division 15 Section "Diffusers, Registers, and Grilles."

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Duct-mounted access doors and panels.
4. Flexible ducts.
5. Concealed damper regulators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

1. Special fittings and manual- and automatic-volume-damper installations.
2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

D. Extruded Aluminum: ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.

B. Frame: 0.063-inch- thick extruded aluminum, with mounting flange.

C. Blades: 0.050-inch- thick aluminum sheet.

D. Blade Seals: Neoprene.

E. Blade Axles: Nonferrous.

F. Tie Bars and Brackets: Aluminum.

G. Return: Spring with adjustable tension adjustable counter balance.

2.3 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

   1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Small Volume Dampers: Dampers smaller than 4 square feet of face area. Multiple- or single-blade, opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

   1. Aluminum Frames: Hat-shaped, 0.063-inch- thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
   3. Blade Axles: Nonferrous.
   4. Tie Bars and Brackets: Aluminum.

C. Large Volume Dampers: Dampers 4 square feet of face area and larger. Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

   1. Aluminum Frames: Hat-shaped, 0.125-inch- thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Extruded-Aluminum Blades: Minimum of 0.081-inch- thick, 6063T extruded aluminum.
   3. Blade Axles: Nonferrous.
   4. Tie Bars and Brackets: Aluminum.

D. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

   1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

F. Each volume damper and splitter damper concealed above an inaccessible ceiling, etc., shall be provided with a shaft extended through the ceiling, to which shall be attached a chrome-plated or painted Ventlock No. 666 concealed damper regulator. No. 680 Ventlock miter gears shall be used where necessary..

2.4 TURNING VANES

A. Fabricate single blade vanes to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."

B. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class.

B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.6 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

C. Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.7 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

E. Label access doors according to Division 15 Section "Mechanical Identification."

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

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SECTION 15853 - POWER VENTILATORS

1 PART - 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. Centrifugal roof ventilators.

B. Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA 99.

C. Fan Unit Schedule: The following information is described in an equipment schedule at the end of this Section.

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 rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

1. Motor ratings and electrical characteristics plus motor and electrical accessories.
2. Material gages and finishes, including color charts.
3. Dampers, including housings, linkages, and operators.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

D. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

E. Maintenance data for power ventilators to include in the operation and maintenance manual specified in Division 1 and in Division 15 Section "Basic Mechanical Requirements."

1.5 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.

D. NEMA Compliance: Provide components required as part of fans that comply with applicable NEMA standards.

E. UL Standard: Provide power ventilators that comply with UL 705.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify clearances.

B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

1.7 COORDINATION AND SCHEDULING

A. Coordinate the size and location of structural steel support members.

B. Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

2 PART - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Centrifugal Roof Ventilators:

    a. Penn Ventilator Co.
    b. Central Blower Co.
    c. Cook (Loren) Co.
    d. Greenheck Fan Corp.
    e. Jenn Industries Inc.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-drive centrifugal fans, as indicated, consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

C. Housing: Removable, extruded-aluminum, rectangular top; square, one-piece, aluminum base with venturi inlet cone.

D. Housing: Removable, galvanized steel, mushroom-domed top; square, one-piece, hinged, aluminum base with venturi inlet cone.

E. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

F. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:

    1. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
    2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
    4. Fan and motor isolated from exhaust air stream.

G. Accessories: The following items are required as indicated:

    1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
    2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
    3. Bird Screens: Removable 1/2-inch mesh, aluminum or brass wire.
    4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
    5. Roof Curbs: Galvanized steel; mitered and welded corners; 2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

        a. Configuration: Self-flashing without a cant strip, with mounting flange.
        b. Overall Height: 12 inches.

2.3 MOTORS

A. Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.

2.4 FACTORY FINISHES

A. Sheet Metal Parts: Prime coat before final assembly.

B. Exterior Surfaces: Baked-enamel finish coat after assembly.

C. Aluminum Parts: No finish required.

2.5 SOURCE QUALITY CONTROL

A. Testing Requirements: The following factory tests are required as indicated:

1. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

3 PART - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install power ventilators according to manufacturer's written instructions.

B. Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 15 Section "Vibration Control."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.3 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Electrical: Conform to applicable requirements in Division 16 Sections.

C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values.

Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, and to report results in writing.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.6 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.7 COMMISSIONING

A. Final Checks before Startup: Perform the following operations and checks before startup:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
7. Disable automatic temperature-control operators.

B. Starting procedures for fans are as follows:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor voltage and amperage.

C. Shut unit down and reconnect automatic temperature-control operators.

D. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

E. Replace fan and motor pulleys as required to achieve design conditions.

END OF SECTION 15853

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SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.

B Related Sections include the following:

1. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
2. Division 15 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

1.3 DEFINITIONS

A Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

A Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

C Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for diffusers, registers, and grilles with factory-applied color finishes. Colors to be off-white, unless otherwise selected by Architect during submittal stage.

D Samples for Verification: Of diffusers, registers, and grilles, in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.

1.5 QUALITY ASSURANCE

A Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated.

B NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Factors
2. Krueger
3. Metal Aire
4. Nailor
5. Price
6. Titus

2.2 REGISTERS, GRILLES, & DIFFUSERS

1. General: The frames for all registers, grilles, and diffusers shall match type of ceiling where they are to be installed. Special frames shall be provided for narrow T-bar ceilings. Refer to reflected ceiling plan and other specification divisions for ceiling type.

2. Exhaust-air registers in other than lay-in ceilings shall be Titus 355FL or 355FS with 40-degree deflection horizontal extruded aluminum blades with opposed-blade damper, baked enamel finish. Exhaust registers from 6 feet 0 inches above floor shall be sight-proof, heavy-duty gymnasium type equal to Titus 33RL or 33RS with horizontal 40-degree deflection blades, baked enamel finish with opposed blade damper.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

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SECTION 15990 - TESTING, ADJUSTING AND BALANCING

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 testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Measuring sound and vibration.
7. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

I. Test: A procedure to determine quantitative performance of a system or equipment.

J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

K. AABC: Associated Air Balance Council.

L. AMCA: Air Movement and Control Association.

M. NEBB: National Environmental Balancing Bureau.

N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Contract Documents Examination Report: Within 90 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

B. Strategies and Procedures Plan: Within 120 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

C. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

D. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

E. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB. Balancing may only be performed by the following:

1. BTC Services, Inc.
2. Certified Testing and Balancing, Inc.
3. R and S Analysis
4. Diamond Test & Balance
5. Tempco

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of

testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 14ays' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

    a. Submittal distribution requirements.
    b. Contract Documents examination report.
    c. Testing, adjusting, and balancing plan.
    d. Work schedule and Project site access requirements.
    e. Coordination and cooperation of trades and subcontractors.
    f. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing" or frame NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. General Warranty: The national project performance guarantee 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. National Project Performance Guarantee: Provide a guarantee on AABC or NEBB forms stating that AABC or NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division 1 Section "Project Record Documents."

D. Examine equipment performance data, including fan. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

J. Examine equipment for installation and for properly operating safety interlocks and controls.

K. Examine automatic temperature system components to verify the following:

1. Dampers and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
4. Sensors are located to sense only the intended conditions.
5. Sequence of operation for control modes is according to the Contract Documents.
6. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
7. Interlocked systems are operating.

L. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Equipment and duct access doors are securely closed.
3. Isolating and balancing valves are open and control valves are operational.
4. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
5. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC or NEBB national standards and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those

removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.
I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Adjust fan speed higher or lower than design to achieve design conditions. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

    a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.

3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.8 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:

    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

F. Equipment Test Reports: For all equipment tested:

1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.

2. Motor Data: Include the following:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.

3. Test Data: Include design and actual values for the following: (all elements of the system that were tested, including air and water flows, static pressures, pump hoods, inlet and outlet static pressures, inlet, outlet pressure type of coils, raws, circuits face areas, inlet, outer wet bulb, dry bulb temperatures, duct sizes tested, inlet and outlet flows temperatures and pressures and all other pertinent data. The report to be organized per each item tested.)

a. Total rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.

3.11 ADDITIONAL TESTS

A. Within 120 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION 15990
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DIVISION 26: ELECTRICAL

26 0000 ELECTRICAL

26 0500 ELECTRICAL GENERAL PROVISIONS
26 0507 ELECTRICAL CONNECTIONS FOR EQUIPMENT
26 0519 CONDUCTORS AND CABLES
26 0526 GROUNDING
26 0529 SUPPORTING DEVICES
26 0532 CONDUIT RACEWAYS
26 0533 ELECTRICAL BOXES AND FITTINGS
26 0923 OCCUPANCY LIGHTING CONTROL AND EQUIPMENT

26 2000 LOW (LINE) VOLTAGE DISTRIBUTION

26 2416 PANELBOARDS
26 2713 SERVICE ENTRANCE
26 2726 WIRING DEVICES
26 2815 OVERCURRENT PROTECTIVE DEVICES
26 2816 MOTOR AND CIRCUIT DISCONNECTS
26 2913 MOTOR STARTERS

26 5000 LIGHTING

26 5100 INTERIOR AND EXTERIOR BUILDING LIGHTING

END OF TABLE OF CONTENTS

SECTION 260500 - 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 are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical work is indicated on drawings and/or specified in Divisions 26, 27 and 28 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	ITEM	SECTION
1.	Electrical General Provisions	260500
2.	Electrical Connections for Equipment	260507
3.	Conductors and Cables	260519
4.	Grounding	260526
5.	Supporting Devices	260529
6.	Conduit Raceways	260532
7.	Electrical Boxes and Fittings	260533
8.	Occupancy Lighting Control and Equipment	260923
9.	Panelboards	262416
10.	Service Entrance	262713
11.	Wiring Devices	262726
12.	Overcurrent Protective Devices	262815
13.	Motor and Circuit Disconnects	262816
14.	Motor Starters	262913
15.	Interior and Exterior Building Lighting	265100

B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.

C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. 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.

1.3 DEFINITION OF TERMS

A. The following terms used in Divisions 26, 27 and 28 documents are defined as follows:

1. "Provide": Means furnish, install and connect, unless otherwise indicated.
2. "Furnish": Means purchase and deliver 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.

1.4 RELATED SECTIONS:

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A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 26, 27 and 28 sections.

C. Earthwork:

1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes, lighting pole foundations, etc. See Division 31, Sitework, and other portions of Divisions 26, 27 and 28, for material and installation requirements.

D. Concrete Work:

1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for under ground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc.See Division 3, Concrete for material and installation requirements.

E. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.

F. Miscellaneous Lumber and Framing Work:

1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.

G. Moisture Protection:

1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

H. Access panels and doors:

1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

I. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

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1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:

1. Electric motors.

1.6 WORK NOT INCLUDED IN THIS DIVISION:

A. Items of work provided under another contract include, but are not necessarily limited to, the following:

1. Telephone raceway, cables or electronic equipment.
2. Control wires for irrigation control valves.

1.7 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.8 QUALITY ASSURANCE:

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. National Electric Code (NEC).
2. International Building Code (IBC).
3. International Fire Code (IFC).
4. International Mechanical Code (IMC).

C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.

1.	UL	Underwriters' Laboratories
2.	ASTM	American Society for Testing Materials
3.	CBN	Certified Ballast Manufacturers
4.	IPCEA	Insulated Power Cable Engineers Association
5.	NEMA	National Electrical Manufacturer's Association
6.	ANSI	American National Standards Institute
7.	ETL	Electrical Testing Laboratories

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D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents which may be in excess of the aforementioned requirements, and not contrary to same.

F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.9 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of $200.00 for the third review and any additional reviews required.

2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.

3. Certifications shall be written or in the form of rubber stamp impressions as follows:

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4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed_____.

Position_____ Date

5. Observe the following rules when submitting the Shop Drawings and Brochures.

a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

b. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

c. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.10 OPERATION AND MAINTENANCE MANUALS:

A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.

B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones B3-367-44). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.

C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).

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D. Include the following information where applicable.

1. Identifying name and mark number.
2. Certified outline Drawings and Shop Drawings.
3. Parts lists.
4. Performance curves and data.
5. Wiring diagrams.
6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
7. Manufacturer's recommended operating and maintenance instructions.
8. Vendor's name and address for each item.

E. The engineer shall review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of $200.00 for each review afterwards.

1.11 RECORD DRAWINGS:

A. Maintain, on a daily basis, a complete set of “Record Drawings”, reflecting an accurate record of work in accordance with the following:

1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)

2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).

3. Show all changes, deviations, addendum items, change orders, job instructions, etc., which change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.

B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The “Record Drawings” for daily recording shall consist of a set of blue line prints of the Contract Drawings.

C. Upon completion of the work, purchase a complete set of electronic drawings. Transfer all “Record” information from the blue line prints to the drawings via the current CAD program in which it was written. The Architect/Engineer shall review the drawings and the Contractor shall incorporate the resulting comments into the final record drawings. The Contractor shall make two complete copies of the drawings electronically and forward this to the Engineer.

D. Certify the “Record Drawings” for correctness by placing and signing the following certifications of the first sheet of the sepia:

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1. "CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By _____ Date

(Name of Electrical Contractor)

By_____ Date

1.12 GUARANTEE:

A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials which develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying 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; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.

C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.

E. Provide only equipment specified in the Contract Documents or approved by addendum.

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2.3 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.

C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

D. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.

E. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

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A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

3.4 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. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

A. General: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner which protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more stringent), unless noted otherwise on drawings.

B. Protect persons from injury at excavations, by barricades, warnings and illumination.

C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

D. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.

E. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.

F. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

G. Retain excavated material which complies with requirements for backfill material. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.

B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.

C. For top 6" of excavation - Top soil.

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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. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 CONCRETE BASES:

A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. 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 404.8.

B. Concrete bases shall be provided under Divisions 26, 27 and 28. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.

C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Utah Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

3.8 ROOF PENETRATIONS:

A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

3.9 FIRE PENETRATION SEALS:

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL

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1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.10 PROJECT FINALIZATION AND START-UP:

A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.

B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.

C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

D. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.

E. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

1.	SYSTEM	FACTORY REPRESENTATIVE
	(List systems included)	(List name and address of Factory Representative).
	_____	_____
	Owner's Representative	Contractor

F. Send copy of acceptance to Architect/Engineer.

3.11 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 260500

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SECTION 260507 - 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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.

B. Refer to Division-23 sections for motor starters and controls furnished integrally with equipment; not work of this section.

C. Refer to Division- 23 section for control system wiring; not work of this section.

D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 – PRODUCTS

2.1 GENERAL:

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 260532, Conduit Raceways; Section 262726 Wiring Devices: and Section 260519 Wire and Cable for additional requirements. Provide final connections for equipment consistent with the following:

B. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.

C. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).

D. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

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PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Refer to basic materials and methods Section 260519, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 260507

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SECTION 260519 - CONDUCTORS AND CABLES (600V AND BELOW)

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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. [Copper Conductors (600V)]

C. Applications for conductors and cables required for project include:

1. Power Distribution
2. Feeders
3. Branch Circuits

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.4 SUBMITTALS:

A. FIELD TEST DATA:

1. Submit megohmmeter test data for circuits under 600 volts.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Service Entrance Conductors – Copper conductor; see drawings for insulation type.

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2. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper conductor; see drawings for insulation type.

3. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.

B. Provide color and coding of conductors as follows:

<u>120/208V</u>

A-Phase - Black

B-Phase - Red

C-Phase - Blue

Neutral - White

Ground - Green

A. Provide colors for switch legs, travelers and other wiring for branch circuits different than listed above.

B. Provide #10 AWG neutral conductor for all three and four wire fluorescent circuit home runs.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.

E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack

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feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.

F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.

G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.

H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and which is listed by UL.

I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.

J. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions.

B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 260519

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SECTION 260526 - 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. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Provide grounding as specified herein, and as indicated on drawings.

B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.

C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.

D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.

E. Types of grounding in this section include the following:

1. Underground Metal Water Piping
2. Metal Building Frames
3. Grounding Electrodes
4. Grounding Rods
5. Service Equipment
6. Enclosures
7. Systems
8. Equipment
9. Other items indicated on drawings

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products which have been UL listed and labeled.

B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS:

A. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

PART 2 – PRODUCTS

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2.1 MATERIALS AND COMPONENTS:

A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.

C. GROUND RODS: Steel with copper welded exterior, 3/4" dia. x 10' long. Weaver or Cadweld.

D. CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND): #2/0 AWG bare copper conductor.

E. INSULATED GROUNDING BUSHINGS: 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 Thomas & Betts #TIGB series.

F. CONNECTIONS TO PIPE: For cable to pipe, OZ/Gedney G-100B series or Thomas & Betts #390X series,, or Burndy type GAR.

G. CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES: For splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld or Thermoweld. If high compression type connectors are used for cable-to-cable, or cable-to-steel, or cable-to-ground rod connections, provide Thomas & Betts #53000 series, or Burndy Hyground series.

H. BONDING JUMPERS: OZ/Gedney Type BJ, or Thomas & Betts #3840 series, or Burndy type GG and type B braid.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.

B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.

C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC. Include copper grounding conductor in all raceway installed in suspended slabs.

D. Provide service entrance grounding by means of ground rods (quantity of two, driven exterior to building), by means of bonding to water main, and by means of bonding to building structural steel. In addition, provide a grounding electrode for not less than 30 lineal feet in concrete footing or foundation which is in direct contract with earth. Size

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electrode in accordance with NEC, but in no case, smaller than No. 4 AWG bare copper. Support electrode so as to be below finished grade near the bottom of the trench, and approximately three inches from the bottom or sides of the concrete. Locate a point of connection for inspection.

E. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.

3.2 GROUNDING ELECTRODES:

A. Concrete Encased Grounding Electrode (UFER Ground): Provide a #2/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Extend electrode through a horizontal length of 30 feet minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils. At point of emergence from concrete, run electrode through a protective non-metallic sleeve and extend to the main building ground bus.

B. Separately Derived Electrical System Grounding Electrode: Ground each separately derived system per requirements in NEC Section 250-26 unless indicated otherwise.

C. GROUNDING ELECTRODE CONDUCTOR: Provide grounding electrode conductor sized per NEC table 250-94 or as indicated.

D. POWER SYSTEM GROUNDING: Connect the following items using NEC sized copper grounding conductors to lugs on the Service Ground Bus.

1. Grounding electrode conductor from concrete encased electrode, and from ground rods,
2. Conductor from main incoming cold water piping system.
3. Conductor from building structural steel.

E. Run main grounding conductors exposed or in metallic conduit if protection or concealment is required.

F. EQUIPMENT BONDING/GROUNDING: Provide a 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. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.

G. 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.

H. Provide bonding wire in all flexible conduit.

3.3 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

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bonding and grounding electrodes as required to comply with resistance limits specified under this Section.

B. Include typewritten records of measured resistance values in the Operation and Maintenance Manual.

C. Use independent testing agency for all testing.

D. Use test equipment expressly designed for the purpose intended. Submit name of testing agency for review and approval, in writing, to the Engineer prior to the performance of any testing.

END OF SECTION 260526

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SECTION 260529 - SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-26 sections. See Section 260532, Raceways, for additional requirements.

B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be

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supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. RACEWAYS:

1. Support raceways which are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90 degree bend. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	3/4" TO 1-1/4" 0	1-1/2" & LARGER 0
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

END OF SECTION 260529

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SECTION 260532 - 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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit
3. Intermediate Metal Conduit
4. Liquid-tight Flexible Metal Conduit
5. Rigid Metal Conduit
6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

C. SUBMITTALS: Not required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. GENERAL:

1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.

C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.

D. PVC EXTERNALLY COATED RIGID STEEL CONDUIT: ANSI C80.1 and NEMA Std. Pub. No. RN 1.

E. ALUMINUM CONDUIT: Not acceptable.

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F. MC CABLE: Not acceptable.

G. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

H. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

I. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

J. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

K. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.

L. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. 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).

M. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

N. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

A. GENERAL:

1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".

B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:

1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.

C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:

D. ANSI/NEMA TC 9, match to duct type and material.

E. HDPE CONDUIT: Not acceptable.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

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2.4 SEALING BUSHINGS:

A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

1. SERVICE ENTRANCE CONDUCTORS:
   a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct.

2. FEEDERS UNDER 600 VOLTS:
   a. Install feeders to panels and motor control centers and individual equipment feeders rated 100 amps and greater, in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct.

3. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
   a. Install in electric metallic tubing (EMT); except in poured walls, with one side in contact with grade, below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in GRC or IMC. In suspended slabs, install in EMT.

B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

C. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.

D. Comply with NEC for requirements for installation of pull boxes in long runs.

E. Cap open ends of conduits and protect other raceways as required against accumulation

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of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

F. Replace all crushed, wrinkled or deformed raceway before installing conductors.

G. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device which supplies uniform heat over the entire area without scorching the conduit.

H. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.

I. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB 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.

J. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

K. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.

L. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

M. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.

N. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

O. Raceway installation below grade:

1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.

2. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

3. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

P. Raceway installation below slab-on-grade, or below grade:

1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a minimum of 4” below gravel sub-base. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and

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to avoid collection of moisture in raceway low points.

2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.

3. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

END OF SECTION 260532

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SECTION 260533 - 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 Specifications sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to electrical wiring boxes and fittings specified herein. See Section 260532, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical box and electrical fitting 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. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.4 SUBMITTALS: None required

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x1-1/2". Provide minimum 2-1/8" depth for boxes with three or more conduit entries.
2. Provide an ‘FS’ box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

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B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

F. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

3. Provide coverplates for all boxes. See Section 262726, Wiring Devices.

4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

5. Provide knockout closures to cap unused knockout holes where blanks have been removed.

6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes

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with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.

7. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.

8. Provide electrical connections for installed boxes.

END OF SECTION 260533

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SECTION 260923 – OCCUPANCY SENSORS

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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of occupancy sensor work is indicated by drawings and schedules.

B. Types of occupancy sensors in this section include the following:

1. Ultrasonic Ceiling Sensors
2. Control Pack
3. Ultrasonic Wall Switch

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors which have been UL listed and labeled.

B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, interconnection diagrams and any related accessories.

B. Submit scaled drawings with lighting fixtures shown clearly marked by manufacturer showing proper product, location and orientation of each sensor.

PART 2 - PRODUCTS

2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

A. ULTRASONIC (MICROPHONICS) WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:

1. Sensor shall utilize active ultrasonics to detect motion.
2. Sensor shall have two ultrasonic transmitters and one receiver.
3. Sensor shall incorporate an inrush current limiter circuit to protect the relay contacts.
4. Sensor shall utilize a dry relay contact for control of the lighting load.
5. Sensor shall have a time out adjustment from 8 seconds to 32 minutes. Timer shall be linear and controlled by a timer chip.
6. Sensor shall have automatic sensitivity adjustment and be microprocessor controlled.
7. Sensor shall have automatic gain setback to reduce the sensitivity after the

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sensor has turned off the lighting to prevent false tripping.

8. Sensor shall have transmitter control adjustments to prevent false tripping from hallway traffic.
9. Sensor shall have a 180 degree field of view, coverage up to 800 square feet, and shall detect six inches of hand movement towards the sensor at a distance of 22 feet. Sensor shall detect body motion towards thesensor at a distance of 32 feet.
10. Sensor shall operate at 120VAC and 277VAC.
11. Sensor shall be rated for 40 to 740 watts at 120VAC and 90 to 1400 watts at 277VAC.
12. Sensor shall be automatic on and shall have an automatic to off override switch on the unit. Switch shall be an air gap switch to disconnect power to the lighting load.
13. Sensor shall have a real time motion indicator on the front of the unit.
14. Sensor shall mount to a single or double gang switch box.
15. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-ATU 1277 Series
    b. Sensorswitch-WSD-PDT-P Series
    c. Mytech LH-US Series
    d. Novitas – 01-250
    e. Leviton – OSSMT-MD Series

B. ULTRASONIC (MICROPHONICS) CEILING SENSOR: Where units indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic technology.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use microprocessor for signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm which adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time-out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if the sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour response to recognition of false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce ultrasonic sensitivity in response to a false off condition.
9. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
10. For airflow which is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
11. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar. An internal 24 hour 7 day clock establishes what periods the room is typically occupied biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
12. Sensor shall be available with either 180 degree or 360 degree coverage pattern.
13. Transducers shall be protected from tampering.
14. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
15. Sensor shall have adjustable sensitivity from 0% to 100%.

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16. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
17. Sensor shall be available with photocell adjustment from 20 to 3,000 Lux.
18. Sensor shall have one (if 180 degrees) or two (if 360 degrees) real time LED motion indicators visible from the front of the unit: Green = ultrasonic.
19. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
20. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-ATU Series
    b. Sensor Switch-CM-PDT Series
    c. Wattstopper-WT Series
    d. Mytech-Omni-US Series
    e. Lithonia - LUSO Series
    f. Novitas – 01-160/100/110/180/190

C. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:

1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.
2. Control module shall be available in versions to accept 120, and 277 VAC line voltages.
3. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).
4. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.
5. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.
6. Relay function shall not require more than 5 mA control current to operate.
7. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.
8. Control module shall be sized to fit inside a standard 4” x 4” junction box.
9. Control module shall be equipped with a 1/2” EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
10. Control module shall be equipable with accessory 1/2” EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
11. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.
12. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-CU Series
    b. Sensor Switch-PP-20 Series
    c. Wattstopper-BEP Series
    d. Mytech-MP Series
    e. Lithonia - LPCS Series
    f. Novitas – 13-051
    g. Leviton – OSC/OSA Series

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PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

D. Contractor shall be on site as required, to adjust lighting control units for proper operation.

E. Mount the switchpack in a standard 4" junction box or extension through a ½" KO in the cover plate. Refer to manufacturer supplied mounting instructions.

F. Provide 5 spare sensors for each type used on project.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 260923

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SECTION 262416 - 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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of panelboard and enclosure work, is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.3 QUALITY ASSURANCE:

A. Provide units which have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub No. 250, "Enclosures for Electrical Equipment (1000 volt maximum). Pub No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

B. SHOP DRAWINGS:

1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

PART 2 – PRODUCTS

ACCEPTABLE MANUFACTURERS:

2.1 MANUFACTURERS:

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

1. Cutler Hammer Products, Eaton Corp.
2. General Electric Company
3. Square D Company

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2.2 PANELBOARDS:

A. GENERAL:

1. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip "spaces" with hardware to receive breaker or switch of size indicated. Provide CU/AL rated lugs of proper size to accommodate conductors specified.

B. LIGHTING AND APPLIANCE PANELBOARDS:

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown. Provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Series rated systems are not acceptable. Equip with copper] bus bars, full-sized neutral bus, and ground bus.

C. PANELBOARD ENCLOSURES:

1. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage minimum 16-gage thickness. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein Bolt engraved plastic laminate labels indicating panel name and voltage on the interior and exterior of panelboards.

D. FINISH:

1. Coat interior and exterior of surface with manufacturer's standard color; baked on enamel finish.

E. IDENTIFICATION:

1. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the interior of each panelboard; include panelboard name and voltage. Provide red plastic laminate labels on emergency system panels.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS:

A. GENERAL:

1. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.

B. MOUNTING:

1. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosures firmly to walls and structural surfaces,

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ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Label circuit breakers to identify location of subpanel or equipment supplied using room numbers and equipment names. Include room number with equipment circuit designations. All directories to be typewritten.

END OF SECTION 262416

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SECTION 262713 - SERVICE ENTRANCE

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. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of service-entrance work is indicated by drawings and schedules.

B. Panels, disconnects, transformers, etc., used for service-entrance equipment are specified in applicable Division-26 sections, and are included as work of this section.

C. Consult local utility relative to all costs for line extensions, connections, etc., and include all costs for bringing service to the facility in base bid. Confirm location of point of service before bidding.

D. Provide labor and materials as required to accomplish power company metering in accordance with power company standards and requirements.

E. Provide concrete pads of size and type required for service transformers. Verify location, size, openings, reinforcing requirements with local utility before beginning work. Comply with local utility and code required clearance requirements.

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of service-entrance equipment and accessories. Provide service-entrance equipment and accessories which are UL-listed and labeled, and equipment marked, "Suitable for use as Service Equipment".

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on service-entrance equipment and accessories.

B. SHOP DRAWINGS: Submit dimensioned layouts of service-entrance equipment and spatial relationships to proximate equipment. Failure to submit said layouts shall not relieve contractor of responsibility to verify required clearances before release of equipment to fabrication.

C. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 2 installed units, but not less than one unit of each.

PART 2 – PRODUCTS

2.1 SERVICE - ENTRANCE EQUIPMENT:

A. GENERAL: Provide service-entrance equipment and accessories, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation, and as herein specified.

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B. Provide each service entrance switchboard with transient voltage surge suppressors as required by Section 16600.

2.2 OVERCURRENT PROTECTIVE DEVICES:

A. GENERAL: Provide overcurrent protective devices complying with Division-26 section "Overcurrent Protective Devices", and as indicated on drawings.

2.3 METERING:

A. METER SOCKETS: Provide meter sockets which comply with requirements of local utility company supplying electrical power to service-entrance equipment of building project.

2.4 RACEWAYS AND CONDUCTORS:

A. GENERAL: Provide raceways and conductors complying with applicable Division-16 Basic Materials and Methods sections.

B. WALL AND FLOOR SEALS: Provide wall and floor seals complying with Division-16 Basic Materials and Methods section "Raceways".

PART 3 – EXECUTION

3.1 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT:

A. Install service-entrance equipment as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.

B. Coordinate with other work, including utility company wiring, as necessary to interface installation of service-entrance equipment work with other work.

3.2 GROUNDING:

A. Provide system and equipment grounding and bonding connections for service-entrance equipment and conductors, as required.

3.3 ADJUST AND CLEAN:

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.4 FIELD QUALITY CONTROL:

A. Upon completion of installation of service-entrance equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 262713

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SECTION 262726 - 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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles
2. Switches

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices which have been UL listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

A. FABRICATED WIRING DEVICES:

B. GENERAL:

1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.

2. Provide wiring devices (of proper voltage rating) as follows:

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MFGR.	RECEPTACLE	SWITCHES 1-POLE	3-WAY	4-WAY	W-PILOT
Hubbell	HBL5352	HBL 1221	HBL 1223	HBL1224	HBL1221-PL
Bryant	5352	1221	1223	1224	1221-PL
Pass Seymour	5352	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	5362	1221	1223	1224	
Cooper	5352	1221	1273	1224	1221-PL

3. Provide devices in colors selected by Architect.

C. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide units of one of the following:

   a. P&S/Sierra
   b. Hubbell
   c. Leviton
   d. Square D

D. WIRING DEVICE ACCESSORIES:

1. WALL PLATES:

   a. Provide stainless steel coverplates for wiring devices. Provide blank coverplates for all empty outlet boxes. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics. Example "208V, 30A".

E. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 406-8 (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 wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

   a. Intermatic WP1020 or WP1030
   b. P&S WIUC10C or WIUC20c

PART 3 – EXECUTION

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in

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boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.

C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit to which the device is connected. Example: "CKT A-1".

D. Install blank plates on all boxes without devices.

E. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.

F. Install GFI receptacles for all receptacles installed in restrooms, outdoors or within six feet of any sink.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. At time of substantial completion, replace those items, which have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 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.

END OF SECTION 262726

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SECTION 262815 - OVERCURRENT PROTECTIVE 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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 262413, Switchgear and Switchboards, and Section 262416, Panelboards.

B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:

1. Molded case circuit breakers
2. Fusible switches
3. Fuses

C. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

B. SHOP DRAWINGS: Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.

C. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):

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B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:

1. Cutler Hammer Products, Eaton Corp.
2. General Electric Co.
3. Square D Co.

C. MOLDED CASE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.

D. FUSIBLE SWITCHES:

1. Provide factory-assembled fusible switch units for power distribution panelboards and switchboards, and individual mounting as indicated. Provide switch units of amperage, voltage, and RMS interrupting rating as shown, with quick-make, quick-break mechanisms, visible blades and dual horsepower ratings. Series rated systems are not acceptable. Equip with lockable handles with on-off indication. Interlock switch covers and handles to prevent opening in "ON" position. Provide switch with Class R rejection fuse clip kits. Provide AL/CU rated lugs of proper size to accommodate conductors specified.

2.2 FUSES

A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.

B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.

C. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads, provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or NCLR, SCLR OR KLNR, KLSR).

D. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussman Mfg. Co.
2. Gould Shawmut, Gould Electric Fuse Division
3. Reliance Fuse Div./Brush Fuse Inc.
4. Littlefuse, Inc.

E. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of all overcurrent devices which are furnished in separately mounted enclosures. Provide red labels for devices supplied with emergency power.

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PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.

C. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.

D. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 262815

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SECTION 262816 - MOTOR AND CIRCUIT DISCONNECTS

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-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedule. Work includes complete installations and electrical connections.

1.3 QUALITY ASSURANCE:

A. Provide motor and circuit disconnect switches which have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data including specifications, installation and general recommendations, for each type of motor and circuit disconnect switch required.

B. SHOP DRAWINGS: Submit dimensioned drawings of electrical motor and circuit disconnect switches which have rating of 100 amperes and larger.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

1. Cutler Hammer Products, Eaton Corp.
2. Square D Company
3. General Electric Company

2.2 FABRICATED SWITCHES:

A. GENERAL: Provide disconnect and safety switches as indicated herein. Provide:

1. General duty switches on 240 Volt rated circuits.

B. GENERAL DUTY SWITCHES: Provide general-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break mechanisms. Provide single phase or three phase and with solid neutral as required by application. Equip with operating handle which is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.

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C. FUSES: Provide fuses for switches, as required of classes, types and ratings needed to fulfill electrical requirements for service indicated. Provide spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. See Section 16180 Overcurrent Protective Devices for fuse types.

D. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect. Provide red plastic laminate labels on disconnects supplied with emergency power.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES:

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position.

END OF SECTION 262816

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SECTION 262913 - 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-26 Basic Materials and Methods section, and is part of Division-26 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starters in this section include the following:

1. AC Fraction Horsepower Manual Starters
2. AC Line Voltage Manual Starters

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on motor starters.

B. SHOP DRAWINGS: Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.

C. MOTOR VOLTAGE/CURRENT REPORT: After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.

PART 2 - PRODUCTS

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Allen-Bradley Co.
2. Appleton Electric Co.
3. Crouse-Hinds Co.
4. Eaton Corp., Cutler Hammer Products
5. General Electric Co.
6. Square D Co.

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 5 units of each, for both power and control circuit fuses.

2.2 MOTOR STARTERS:

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A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information and as required for complete installations.

B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.

C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

A. Install motor starters as indicated, 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.

B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

C. IDENTIFICATION: 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 starters supplied by emergency power. Include mechanical equipment designation, horsepower and voltage.

3.2 ADJUST AND CLEAN:

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 262913

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SECTION 265100 - 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. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Types of lighting fixtures in this section are indicated by schedule and include the following:

1. High-Intensity-Discharge (HID)
2. Fluorescent

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Comply with NEC 410-65C for all recessed incandescent light fixtures. Provide lighting fixtures which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on interior and exterior building lighting fixtures.

B. SHOP DRAWINGS:

1. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet. Submit all available standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided. Submit ballast manufacturer cut sheets. Submit a list of all lamps used on all projects.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):

1. HID MAGNETIC BALLASTS:

a. Advance Transformer Co.
b. Universal Lighting Technologies Co.
c. Venture Lighting International

2. FLUORESCENT LAMPS:

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a. General Electric Co.
b. Osram Sylvania
c. Phillips Lighting Corp.

3. HID LAMPS:

a. General Electric Co.
b. Osram Sylvania
c. Phillips Lighting Corp.
d. Venture Lighting International

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

2. Comply with manufacturer's written recommendations for all lamp ballast combinations.

3. Equip outdoor fixtures with low temperature starting ballasts.

C. BALLAST FUSING:

1. Provided in-line fusing for all fluorescent and HID ballasts. For fluorescent ballasts, provide GLR fuses and HLR -in-line fuse holders for each ballast. For HID fixtures provide KTK fuses and HPF fuse holders. Size fuses per ballast manufacturer's recommendation.

a. Comply with manufacturer's written recommendations for all lamp ballast combinations.
b. Equip outdoor fixtures with low temperature starting ballasts.

D. FLUORESCENT LAMP BALLASTS: - (ELECTRONIC):

1. Provide rapid start, fluorescent programmable start lamp ballasts capable of operating lamp types indicated, with power factor(ratio of actual power to apparent power) above 95%, ballast factor of .71, and operating with audible noise level lower than the quietest C.B.M. certified ballast for the same application, listed as class A. Provide ballasts which comply with applicable state, federal, and industry standards and:

a. Are UL listed,
b. Comply with FCC requirements governing electromagnetic and radio

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frequency interference.

c. Comply with IEEE standards for line voltage transient protection, and ANSI C.62.41 for location director A3 in the normal mode and location category A1 in the common mode.

d. Comply with ANSI and IEEE standards for harmonic distortion

2. Light output shall not vary by more than 1% over a plus or minus 10% variation in line voltage, and shall not vary more than 5% of light output of equivalent C.B.M. certified ballast. See drawings and schedules for input voltage requirements. Ballasts shall consistently start and operate lamps from a supply line voltage of plus or minus 10% from nominal line voltage.

3. Provide ballasts which operate at a frequency above 20K hz from an input frequency of 60 hz; have an efficacy factor (relative light output per watt consumed) at least 10% above the C.B.M. certified electromagnetic system for the same application; and have a lamp crest factor (ratio of peak to R.M.S. lamp current) of 1.7 or less. Ballasts shall have a total current harmonic distortion of less than 10%.

4. All T5 and Compact electronic ballasts shall be programmed rapid 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. T8 ballasts shall be rapid start unless specified on the fixture schedule otherwise.

5. Ballasts for lamps of T5, T4, and T2 diameter shall contain end-of-life sensing circuitry to prevent lamp, lamp base, or socket damage at end-of-life.

6. Ballast manufacturer shall warrant ballasts for T8 and T5 lamps to be free from defects in material or workmanship for at least 5 years from date of manufacture. Ballasts for T4 and smaller shall be 3 years. Contractor shall provide warrantee in accordance with other sections of this specification. Warranty shall include an allowance for nominal replacement labor and replacement of defective product.

7. Comply with manufacturer's written recommendations for all lamp ballast combinations. Provide electronic ballasts of one of the following:

   a. Motorola
   b. Advance Transformer Company
   c. Howard Industries
   d. Osram Sylvania
   e. Universal Lighting Technologies Co.

8. CBM LABELS:

   a. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

E. FLUORESCENT LAMPS:

1. Equip interior fluorescent fixtures with full light output, T8 lamps where available as standard products. Where applicable, equip fixtures with lamps as follows:

4' T8	3150	Initial Lumens, average life of 24,000 hours.

   a. Sylvania Octron

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b. General Electric
c. Phillips.

2. Provide fluorescent lamps with low levels of mercury, capable of acceptance of the Environmental Protection Agency (EPA) through the TCLP (Toxic Characteristic Leaching Procedure).

F. HIGH-INTENSITY-DISCHARGE-LAMP BALLASTS:

1. Provide HID ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly match lamps to power line by providing appropriate voltage and impedances for which lamps are designed. Equip exterior fixtures with low temperature starting ballasts. Provide high power factor, or power factor improved ballasts.

G. HID LAMPS:

1. Equip fixtures with HID lamps as specified. Provide coordinated lamp ballast combination to ensure full light output (rated lumens) of lamp. Where lamp manufacturer recommends operation of lamp in enclosed fixtures, provide suitable enclosure for fixtures specified. Include detailed drawing of enclosure with shop drawing submittal.

H. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

D. Provide each lay-in light fixture with at least 36" (Not to exceed 72") of 3/8" steel flexible conduit.

E. Coordinate lighting in mechanical room with duct and equipment locations.

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F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to insure fire rating of each ceiling in which fixtures are installed.

G. COORDINATION MEETINGS:

1. Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.

2. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.

H. ADJUST AND CLEAN:

1. Clean lighting fixtures of dirt and debris upon completion of installation.

2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.

I. SPARE PARTS:

1. Provide 2 spare sets of diffusers (acrylic and/or glass only) for each fixture type.

2. In addition, furnish stock of replacement lamps amounting to 12 of each type and size used. Deliver replacement stock as directed to Owner's storage space.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.

C. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.

D. GROUNDING:

1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 265100

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DIVISION 31: EARTHWORK

31 0000 EARTHWORK

31 0501 COMMON EARTHWORK REQUIREMENTS

31 2000 EARTH MOVING

31 2216 FINE GRADING
31 2323 FILL
31 2324 GRANULAR BASE

END OF TABLE OF CONTENTS

SECTION 31 0501

COMMON EARTHWORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited to:
   1. General procedures and requirements for earthwork.
   2. State Parks to demolish existing restrooms to make way for new restrooms.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification Of Conditions:
   1. Verify locations of severed utilities from State Parks prior to footing pouring.
   2. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.
   3. Perform investigative excavating 10 days minimum in advance of performing any excavation or underground work.
   4. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.

3.2 PREPARATION

A. Protection:
   1. Spillage:
      a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
      b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
   2. Dust Control:
      a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
      b. Correct or repair damage caused by dust.
      c. Register and file an application with the State of Utah Air Quality Division for this project and maintain silt fencing and erosion control throughout project.
   3. Existing Plants And Features: Do not damage tops, trunks, and roots of existing trees and shrubs on site that are intended to remain. Do not use heavy equipment within branch spread. Interfering branches may be removed only with permission of Architect. Do not damage other plants and features that are to remain.

B. If specified precautions are not taken or corrections and repairs not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of The Work.

3.3 REPAIR / RESTORATION

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults that require adjustment.

3.4 FIELD QUALITY CONTROL

A. Notify geo-tech 48 hours before performing scarification and fill process.

B. If weather, scheduling, or any other circumstance has interrupted work, notify Architect 24 hours minimum before intended resumption of grading or compacting.

C. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils that have been exposed to adverse weather conditions.

END OF SECTION

SECTION 31 2216

FINE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform fine grading work required to prepare site for paving finish grading.

B. Related Sections:
   1. Section 31 0501: Common Site Construction Requirements.
   2. Section 32 1216: Finish grading for asphalt paving.
   3. Section 32 1313: Finish grading for concrete paving.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not commence work of this Section until grading tolerances specified in Section 31 2213 are met.

3.2 PREPARATION

A. Protection: Protect utilities and site elements from damage.

3.3 PERFORMANCE

A. Site Tolerances:
   1. Maximum variation from required grades shall be 1/10 of one foot 28 mm.
   2. To allow for final finish grades of concrete and asphalt paving.

B. Do not expose or damage existing shrub or tree roots.

C. Slope grade away from building. Direct surface drainage in manner indicated on Drawings by molding surface to facilitate natural run-off of water. Fill low spots and pockets with specified fill material and grade to drain properly.

END OF SECTION

SECTION 31 2323

FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform Project scarification, backfilling and compacting as described in Contract Documents, except as specified below.
   2. Procedure and quality for backfilling and compacting performed on Project under other Sections unless specifically specified otherwise.

B. Related Sections:
   1. Section 31 0501: Common Earthwork Requirements.
   2. Division 32: Compaction of sub-grade under concrete slabs and paving.
   3. Performance of backfilling and compacting inside and outside of building required for electrical and mechanical work is responsibility of respective Section doing work unless arranged differently by Contractor.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM D 1557-02, 'Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.'
   2. ASTM D 2216-98, 'Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.'
   3. ASTM D 2487-00, 'Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).'
   4. ASTM D 2922-01, 'Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).'
   5. ASTM D 3017-01, 'Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).'

1.3 DEFINITIONS

A. Relative Compaction: Ratio of field dry density as determined by ASTM D 2922 and ASTM D 3017 or 2216, and laboratory maximum dry density as determined by ASTM D 1557.

1.4 SEQUENCING

A. Do not backfill against bituminous dampproofing for 24 hours after application of dampproofing.

B. Before backfilling, show utility and service lines being covered on record set of Drawings. Do not backfill until utilities involved have been tested and approved by Architect and until instructed by Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Site Material: Existing State Park excavated material on site is not suitable for use as fill and backfill to meet Project requirements.

B. Imported Fill / Backfill:
   1. Well graded material conforming to ASTM D 2487 free from debris, organic material, frozen materials, brick, lime, concrete, and other material which would prevent adequate performance of backfill.
      a. Under Building Footprint And Paved Areas: Fill shall comply with soil classification groups GW, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches 150 mm diameter and 90 percent minimum of fill shall be smaller than 1-1/2 inch 38 mm in any direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before placing fill, base, or finish work, prepare sub-grade as follows:
   1. Do not place fill or base over frozen sub-grade.
   2. Under Building Slabs / Pads, Concrete Site Elements, And Concrete Driveways And Parking Areas: Scarify sub-grade 6 inches 150 mm deep, moisture condition to uniform moisture content of between optimum and 4 percent over optimum, and mechanically tamp 6 inches 150 mm deep to 90 percent minimum of relative compaction.
   3. Under Asphalt Driveways And Parking Areas: Scarify sub-grade 6 inches 150 mm deep, moisture condition to uniform moisture content between optimum and 4 percent over optimum, and mechanically tamp to 95 percent minimum of relative compaction.

3.2 PERFORMANCE

A. Fill / Backfill:
   1. General:
      a. Around Buildings And Structures: Slope grade away from building as specified in Section 31 2216. Hand backfill when close to building or where damage to building might result.
      b. Site Utilities:
         1) In Landscape Areas: Use backfill consisting of on-site soil.
         2) Under Pavement And Concrete Site Elements: Use imported structural fill compacted to 95%.
      c. Do not use puddling or jetting to consolidate fill areas.
   2. Compacting:
      a. Fill / Backfill And Base:
         1) Under Building Slabs or Pads, Driveways, And Parking Areas: Place in 8 inch 200 mm maximum layers, dampen (do not soak), and mechanically tamp to 95 percent minimum of maximum density as established by ASTM D 1557.
         2) Under Concrete Site Elements And Around Foundation Walls: Place in 8 inch 200 mm maximum layers, dampen but do not soak, and mechanically tamp to 95 percent minimum of maximum density as established by ASTM D 1557.
         3) Utility Trenches:
            a) Site: Place fill in 12 inch 300 mm layers and moisture condition to plus or minus 2 percent of optimum moisture content. Compact fill to 90 percent minimum relative compaction to within 12 inches 300 mm of finish grade. Compact fill above 12 inches 300 mm to 85 percent relative compaction.
            b) Under Slabs: Place fill in 6 inch 150 mm layers, moisture condition to plus or minus 2 percent of optimum moisture content, and compact to 95 percent

minimum relative compaction to within 4 inches 100 mm of finish grade. Final 4 inches 100 mm of fill shall be granular base as specified in Section 31 2324.

4) Fill Slopes: Compact by rolling or using sheepsfoot roller.
5) Backfill Under Footings: Not allowed.
6) Other Backfills: Place other fills in 12 inch 300 mm layers and compact to 90 percent relative compaction.

3.3 REPAIR / RESTORATION

A. Repair damage to other portions of the Work resulting from work of this Section at no additional cost to Owner. On new work, arrange for damage to be repaired by original installer.

3.4 CLEANING

A. Debris and material not necessary for Project are property of Contractor and are to be removed before completion of Project. However, if material necessary for Project is hauled away, replace with specified fill / backfill material.

END OF SECTION

SECTION 31 2324

GRANULAR BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install granular base under interior and exterior slabs-on-grade.

B. Products Installed But Not Supplied Under This Section:
   1. Under-slab vapor retarder and seam tape.

C. Related Sections
   1. Section 03 3053: Granular base under miscellaneous cast-in-place concrete.
   2. Section 07 2616: Furnishing of vapor retarder and seam tape.
   3. Section 31 0501: Common Earthwork Requirements.
   4. Section 32 1313: Base course under concrete paving.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM E 1643-98, 'Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.'

1.3 SEQUENCING

A. Install vapor retarder and granular base system before placing concrete.

PART 2 - PRODUCTS

2.1 GRANULAR BASE

A. Gravel: 1/4 inch 6mm minimum to one inch 25 mm maximum well-graded, clean gravel or crushed rock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vapor retarder in accordance with ASTM E 1643 and following instructions:
   1. Install vapor retarder over compacted sub-grade and tops of interior stem walls so entire area under slab is covered.
   2. Lap joints 3 inches 75 mm minimum and seal with specified seam tape.
   3. Seal vapor retarder around pipes, conduits, and other utility items that penetrate vapor retarder using factory-fabricated boot installed as recommended by Manufacturer.
   4. Except for punctures required for reinforcing and anchor bolts at top of stem walls, seal tears and punctures before placing granular base.

B. Place 4 inches 100 mm minimum of granular base over vapor retarder, level, and compact with two passes of 2-1/2 ton minimum roller.

C. Do not allow water onto vapor retarder or granular base before placing concrete.

3.2 FIELD QUALITY CONTROL

A. Notify Architect 2 days before installation of concrete to allow inspection of vapor retarder and granular base installation.

END OF SECTION

DIVISION 32: EXTERIOR IMPROVEMENTS

32 1000 BASES, BALLASTS, AND PAVING

32 1723 PAVEMENT MARKINGS

END OF TABLE OF CONTENTS

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish material and apply pavement and curb markings as described in Contract Documents.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Paint handicap spaces to conform to ADA Standards and local code requirements.

1.3 PROJECT CONDITIONS

A. Project Environmental Requirements:
   1. Apply only on dry surfaces, during favorable weather, and when damage by rain, fog, or condensation not anticipated.
   2. Latex Paint:
      a. Atmospheric temperature above 50 deg F 10 deg C.
      b. When temperature is not anticipated to drop below 50 deg F 10 deg C during drying period.
   3. Alkyd or Chlorinated Rubber Paint:
      a. Atmospheric temperature above 40 deg F 4 deg C.
      b. When temperature is not anticipated to drop below 40 deg F 4 deg C during drying period.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Paint:
   1. Non-reflectorized.
   2. Types:
      a. Acrylic Latex for uncured paving.
      b. Alkyd or chlorinated rubber for cured paving.
   3. Colors:
      a. Yellow: Parking stripes, crosswalk stripes, and safety markings.
      b. Blue And White: Handicapped markings.

B. Preformed Thermoplastic:
   1. Reflectorized.
   2. Colors:
      a. Yellow: Parking stripes, crosswalk stripes, and safety markings.
      b. Blue And White: Handicapped markings.
   3. Category Four Approved Product. See Section 01 6200 for definitions of Categories.
      a. Premark Plus by Flint Trading Inc, Thomasville, NC www.flinttrading.com.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not apply acrylic latex system until paving has cured 7 days minimum. Do not apply alkyd or chlorinated rubber systems until paving has cured 3 months minimum.

B. Surfaces shall be dry and free of grease and loose dirt particles. Scrape and wire brush chipped or damaged paint on existing curbs.

C. Perform layout with chalk or lumber crayon only.

3.2 APPLICATION

A. Site Tolerances:
   1. General: Make lines parallel, evenly spaced, and with sharply defined edges.
   2. Line Widths:
      a. Plus or minus 1/4 inch 6 mm variance on straight segments.
      b. Plus or minus 1/2 inch 13 mm variance on curved alignments.

B. Provide two coat application, each coat applied at 150 sq ft per gal. Apply second coat after three hours minimum or when first coat is thoroughly dried, whichever is longer.

3.3 CLEANING

A. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect before performance.

END OF SECTION