



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

April 30, 2008

PROMONTORY HALL HVAC UPGRADES

UTAH STATE FAIR PARK

SALT LAKE CITY, UTAH

DFCM Project Number 07211370

HFS Architects
1484 South State Street
Salt Lake City Utah
801-596-0691

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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 General Conditions dated May 25, 2005.

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

Technical Specifications :

Drawings:

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

NOTICE TO CONTRACTORS

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

**PROMONTORY HALL HVAC UPGRADE
UTAH STATE FAIR PARK, SALT LAKE CITY, UTAH
DFCM PROJECT NO: 07211370**

Bids will be in accordance with the Contract Documents that will be available on Wed., **April 30, 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 Tim K Parkinson DFCM, at 801-450-2478 No others are to be contacted regarding this bidding process. The construction budget for this project is \$ 190,000.00

A **mandatory** pre-bid meeting will be held at **10:00 AM on Tuesday, May 6, 2008** at Utah State Fair Park, 155 North 1000 West Salt Lake City Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of **3:00 PM on Tuesday, May 20, 2008** at DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

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

Work includes the removal of 2 ea. existing evaporative cooling units located on the roof of the Promontory Hall Facility. Install new Electrical service to support the new Installed DX Cooling Unit. Install all associated duct work and Electrical according to the Contract Documents. Patch and repair all roofing to match existing.

Alternate: Includes Restroom Counter tops and new Painted epoxy floor



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

PROJECT SCHEDULE

PROJECT NAME: Promontory Hall HVAC Upgrade				
Utah State Fair Park – Salt Lake City, Utah				
DFCM PROJECT NO. 07211370				
Event	Day	Date	Time	Place
Bidding Documents Available	Wednesday	April 30, 2008	2:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-bid Site Meeting	Tuesday	May 6, 2008	10:00 AM	Utah State Fair Park 155 North 1000 West Salt Lake City Utah
Last Day to Submit Questions	Friday	May 9, 2008	2:00 PM	<i>Tim Parkinson</i> – DFCM E-mail tparkins@utah.gov Fax 801-538-3267
Addendum Deadline (exception for bid delays)	Wednesday	May 14, 2008	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Tuesday	May 20, 2008	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Wednesday	May 21, 2008	3:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Friday	August 29, 2008	5:00 PM	155 North 1000 West Salt Lake City Utah

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



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

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 **Promontory Hall HVAC Upgrades – Utah State Fair Park – Salt Lake City, Utah DFCM Project No. 07211370** 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)

Add Alternate #1 New and Installed Restroom counter tops and New painted Epoxy Floors in Resrooms

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

I/We guarantee that the Work will be Substantially Complete by **August 29 2008**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$250.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

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

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

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

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days,

unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. BID FORM
PAGE NO. 2

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 100% 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.

**Division of Facilities Construction and****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

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
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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.

Table with 4 columns: 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 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%

CONTRACTOR'S AGREEMENT
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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.

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. 1953, 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, 1953, 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: _____ (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



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.

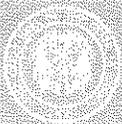
The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$_____. If the list of items is 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

**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
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

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

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

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
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

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

Signed by:	Date:	Mean Score
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Additional Comments:

PROJECT MANUAL

DFCM #07211370

HFSA #0740.01

8 April 2008

Promontory Hall HVAC Upgrade Utah State Fairpark

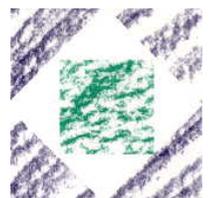


State of Utah—Department of Administrative Services

**DIVISION OF FACILITIES CONSTRUCTION
AND MANAGEMENT**

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018

HFS*Architects*



ARCHITECTURE

INTERIORS

PLANNING

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SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Type of the Contract.
 - 3. Use of premises.
 - 4. Owner's occupancy requirements.
 - 5. Work restrictions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Promontory Hall HVAC Upgrade.
 - 1. Project Location: Utah State Fairpark, Salt Lake City, Utah.
- B. Owner: DFCM, 4110 State Office Building, Salt Lake City, Utah 84114.
 - 1. Owner's Representative: Tim Parkinson.
- C. Architect: HFS Architects, 1484 South State Street, Salt Lake City, Utah 84115.
- D. The Work consists of the following:
 - 1. The Work includes removal of the existing evaporative cooling, new DX cooling, ductwork, metal studs and gypsum board, hollow metal frame, flush doors, finish hardware, roof deck patching and asphalt shingle patching new counter tops in the restrooms, new epoxy floor in the restrooms, and new electrical service to the building.

1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

1.5 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine constructions operations to the construction limit line shown on the drawings.
 - 2. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 - 3. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following condition:
 - 1. 72-hour notice of shut-down coordinated with owner.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: New counters, cabinets and resinous (epoxy) floor in the two restrooms. Note that this will require removing and replacing the existing plumbing fixtures. Base bid leaves the restrooms as is.

END OF SECTION 01230

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
 3. Number of Copies: Submit six opaque copies of each submittal. Architect will return three.
 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

1.6 PROJECT MEETINGS

- A. General: The Architect will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform subcontractors and suppliers and others involved, and individuals whose presence is required, of date and time of each meeting.
 - 2. Minutes: The Architect will record significant discussions and agreements achieved.

- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
 - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for requests for interpretations (RFIs).
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
 - 3. Minutes: Architect will record and distribute meeting minutes.

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

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related requests for interpretations (RFIs).
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Architect will conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Requests for interpretations (RFIs).
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
3. Minutes: Architect will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

HFS Architects
DFCM #07211370
HFSA #0740.01

Promontory Hall
HVAC Upgrade
Utah State Fairpark

END OF SECTION 01310

SECTION 01322 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Preconstruction videotapes.
- B. Related Sections include the following:
 - 1. Division 1 Section "Submittal Procedures" for submitting photographic documentation.
 - 2. Division 1 Section "Cut and Patch" for photographic documentation before selective demolition operations commence.
 - 3. Division 1 Section "Selective Demolition" for photographic documentation before selective demolition operations commence.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.
- B. Videotape Format: Provide high-quality, 1/2-inch, VHS color videotape in full-size cassettes, T-90 minutes long.
 - 1. Tape quality shall be adequate to create photographic prints to be made from individual frames.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in filename for each image.
 - 2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference.
- C. Preconstruction Photographs: Before commencement of demolition and starting construction, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take fifteen photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

3.2 CONSTRUCTION VIDEOTAPES

- A. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each videotape, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- B. Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
- C. Preconstruction Videotape: Before starting demolition, record videotape of Project site and surrounding properties from different vantage points.
 - 1. Flag construction limits before recording construction videotapes.
 - 2. Show existing conditions adjacent to Project site before starting the Work.
 - 3. Show protection efforts by Contractor.

END OF SECTION 01322

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 2. Division 1 Section "Closeout Procedures" for submitting warranties.
 - 3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals..
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

- a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- E. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number, numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "Reviewed, no exceptions taken", or "Furnish as corrected".
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating "Reviewed, no exceptions taken", or "Furnish as corrected" taken by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

SUBMITTAL PROCEDURES

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

- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.

- 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit five copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Prepare bar chart schedule and submit every week at the Construction Progress Meeting.

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

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit five copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

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

1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

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

C. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS)

and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

- D. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- E. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- H. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- I. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S / ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for limitations on utility interruptions and other work restrictions.
 - 2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Divisions 2 through 16 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber and Plywood: Comply with requirements in Division 6 Section " Miscellaneous Carpentry."
- B. Gypsum Board: Minimum ½ inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

2.2 TEMPORARY FACILITIES

- A. Port-A-Potty

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install lighting for Project identification sign.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 3. Provide superintendent with cellular telephone for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
 - B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 - C. Parking: Provide temporary parking areas for construction personnel.
 - D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
 - E. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - 1. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
 - F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
 - G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
 - H. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.
 - I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
 - J. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
- 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 1 Section "Summary."
- B. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 2. Construct dustproof partitions with 2 layers of 3-mil polyethylene sheet on each side. Cover floor with 2 layers of 3-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 3. Insulate partitions to provide noise protection to occupied areas.
 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 5. Protect computer equipment.
 6. Protect air-handling equipment.
 7. Weather strip openings.
 8. Provide walk-off mats at each entrance through temporary partition.
- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Smoking is prohibited inside the building. Outside smoking is prohibited within 25 feet of building.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - a. All welding operations require a fire watch.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

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Promontory Hall
HVAC Upgrade
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END OF SECTION 01500

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
 - 2. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: Provide 72-hour notice to Owner prior to commencing cutting and patching procedures which will disturb or affect mechanical/electrical systems or service.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Fire-suppression systems.
 - 2. Mechanical systems piping and ducts.
 - 3. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - 1. Water, moisture, or vapor barriers.
 - 2. Exterior curtain-wall construction.
 - 3. Piping, ductwork, vessels, and equipment.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.
 - 1. If possible, retain original Installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original Installer or fabricator, engage another recognized experienced and specialized firm.
 - a. Firestopping.
 - b. HVAC enclosures, cabinets, or covers.
 - c. Roofing membrane.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining

construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Demolition and removal of selected portions of a building or structure.
- 2. Repair procedures for selective demolition operations.

- B. Related Sections include the following:

- 1. Division 1 Section "Summary" for restrictions on use of the premises due to Owner or tenant occupancy.
- 2. Division 1 Section "Photographic Documentation" for documenting the everything within the project limit line, the state of the project site and the existing condition of adjacent structures and buildings prior to commencing demolition and construction of the project.
- 3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
- 4. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
- 5. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Locations of temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Comply with Division 1 Section "Quality Requirements."
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.

- E. Predemolition Conference: Conduct conference at Project site to review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site will not be permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.
 - 1. If possible, retain original Installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original Installer or fabricator, engage another recognized experienced and specialized firm.

- a. Firestopping.
- b. HVAC enclosures, cabinets, or covers.
- c. Roofing membrane.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

- B. Do not interrupt existing utilities serving occupied or operating facilities unless permitted under the following condition:
 - 1. Interruption of power to the Computer Center Rooms 212 and 213 will only be allowed on Friday, November 24, 2006.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - 1. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - 2. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- D. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.
- C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- D. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- E. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- F. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration, to protect computer equipment and to separate areas from fumes and noise.
- G. Temporary Shoring: Provide and maintain interior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
 10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- C. Removed and Salvaged Items: Comply with the following:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 1 Section "Cutting and Patching."
- C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 01732

SECTION
01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 2. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

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

1.4 FINAL COMPLETION

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

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

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

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

1.5 WARRANTIES

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

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch** paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.

- e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Replace parts subject to unusual operating conditions.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01781

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HFSA #0740.01

Promontory Hall
HVAC Upgrade
Utah State Fairpark

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and grading subgrades for slabs-on-grade, walks, and pavements.
 - 2. Subbase course for walks and pavements.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 2 Section "Site Clearing" for stripping, grubbing, topsoil removal, and tree protection.
 - 2. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.
 - 3. Division 3 Section "Cast-In-Place Concrete" for concrete encasings, cradles, and appurtenances for utility systems.

1.3 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- E. Base Course: The layer placed between the subbase and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum density curve for each soil material.
 - 3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.
- C. Photographs of existing adjacent structures and site improvements.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. See also 'Structural General' notes.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.
- E. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, with at least 95 percent passing a 1-1/2 inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Subbase or base materials.
- G. Bedding Material: Subbase or base materials with 100 percent passing a 1 inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 8 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.3 EXCAVATION

- A. Explosives: Do not use explosives.

- B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.5 APPROVAL OF SUBGRADE

- A. Notify Architect when excavations have reached required subgrade.
- B. When Architect determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.
- D. Contractor shall retain soil engineer to view and approve subgrade. Preparation prior to commencing with replacement fill. Prepare written report of findings.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.
 - 1. Fill unauthorized excavations under other construction as directed by the Architect.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.

3.9 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
- B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density.
- C. Place fill material in layers to required elevations for each location listed below.
 1. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.

3.10 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.11 COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557:
 1. Under structures and building slabs, compact the top 12 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 2. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 3. Under landscaped areas, compact the top 6 inches below subgrade and each layer of backfill

or fill material at 90 percent maximum dry density.

3.12 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between existing adjacent grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
 - 2. Walks: Plus or minus 0.10 foot.
 - 3. Pavements: Plus or minus ½ inch.
- C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10 foot straightedge.

3.13 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.
 - 1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.
 - 2. Shape subbase and base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
 - 4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
- B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.14 DRAINAGE FILL

- A. Under slabs-on-grade, place drainage fill course on prepared subgrade.
 - 1. Compact drainage fill to required cross sections and thickness.
 - 2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.
 - 3. When compacted thickness of drainage fill exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.15 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Owner will employ a testing agency to perform tests and to submit test reports.
- B. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
 - 1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.
- a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
 - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
- 2. Compaction:
 - a. Exterior Walks/Ramps - One test per lift per each 40 lin. ft.
 - b. Exterior Flatwork- one test per lift per each 2000 SF.
 - 3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of wall length, but no fewer than two tests along a wall face.
 - 4. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 50 feet or less of trench, but no fewer than two tests.
- C. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Transport surplus satisfactory soil to designated storage areas on the Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 02741 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Hot-mix asphalt paving.
- 2. Pavement-marking paint.

- B. Related Sections include the following:

- 1. Division 2 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
 - 1. Standard Specification: State of Utah "Standard Specifications for Road and Bridge Construction" most current edition.
 - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.
- E. Qualification Data: For manufacturer.
- F. Material Test Reports: For each paving material.
- G. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with of Utah Department of Transportation for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: UDOT Standard Specification Section 704.
- B. Prime Coat: Asphalt emulsion prime complying with UDOT requirements.
- C. Tack Coat: UDOT Standard Specification 404.
- D. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073, Grade Nos. 2 or 3.
- C. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.
 - 1. Color: Match existing campus colors- blue, white, red and yellow.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes designed according to procedures in UDOT Standard Specification Section 402 and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: comply with UDOT standard specification
 - 3. Surface Course: comply with UDOT standard specification

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.

3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Spread mix at minimum temperature of 250 deg F.
 - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: 8 inches, plus or minus ½ inch.
 - 2. Surface Course: 3 inches, plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: Plus or minus ½ inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 ASPHALT RAMPS

- A. Construct hot-mix asphalt ramps over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.
 - 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to cross section indicated or, if not indicated, to local standard shapes, by machine or by hand. Tamp hand-placed materials and screed to smooth finish. PAVEMENT MARKING
- C. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- D. Allow paving to age for 30 days before starting pavement marking.
- E. Sweep and clean surface to eliminate loose material and dust.
- F. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 02741

SECTION 02751 - CEMENT CONCRETE PAVEMENT

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 all exterior cement concrete pavement for the following, including items shown in Civil, Landscape, Architectural, Mechanical/Plumbing, and Electrical Drawings.

- 1. Driveways and roadways.
- 2. Curbs and gutters.
- 3. Walkways.
- 4. Exterior stairs.
- 5. Base under unit pavers.

- B. Related Sections include the following:

- 1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
- 2. Division 7 Section "Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
- 3. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.

5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or adhesive.
8. Joint fillers.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Work shall be done by the General Contractor, or an experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- D. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.
- F. Guarantee: Provide two (2) year written guarantee to promptly remove and replace concrete which pits, spalls, or cracks. Guarantee shall start at the date of substantial completion. Replacement work shall carry a new two year guarantee.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.

- B. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer coated wire bar supports.
- D. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II, low alkali.
 - 1. Fly Ash: ASTM C 618, Class F.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
 - 1. Class: 4S.
 - 2. Maximum Aggregate Size: 3/4" inch nominal.
 - 3. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water: ASTM C 94.

2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Nylon fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1 inch long.

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

1. Fibrillated Fibers:
 - a. Con-trol.
 - b. Fibermesh; Fibermesh, Div. of Synthetic Technologies.
 - c. Forta CR; Forta Corporation.
 - d. Nycon.

2.6 CURING MATERIALS

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

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

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

1. Evaporation Retarder:
 - a. Cimfilm; Axim Concrete Technologies.
 - b. Finishing Aid Concentrate; Burke Group, LLC (The).
 - c. Spray-Film; ChemMasters.
 - d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
 - e. Sure Film; Dayton Superior Corporation.
 - f. Eucobar; Euclid Chemical Co.
 - g. Vapor Aid; Kaufman Products, Inc.
 - h. Lambco Skin; Lambert Corporation.
 - i. E-Con; L&M Construction Chemicals, Inc.
 - j. Confilm; Master Builders, Inc.
 - k. Waterhold; Metalcrete Industries.
 - l. Rich Film; Richmond Screw Anchor Co.
 - m. SikaFilm; Sika Corporation.
 - n. Finishing Aid; Symons Corporation.
 - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound:
 - a. AH Curing Compound #2 DR; Anti-Hydro International, Inc.
 - b. Res-X Cure All Resin; Burke Group, LLC (The).
 - c. RX Cure; Conspec Marketing & Manufacturing Co., Inc.
 - d. Day-Chem Rez Cure; Dayton Superior Corporation.
 - e. Kurez DR; Euclid Chemical Co.
 - f. Nitocure S; Fosroc.
 - g. #64 Resin Cure; Lambert Corporation.
 - h. L&M Cure DR; L&M Construction Chemicals, Inc.
 - i. 3100-Clear; W. R. Meadows, Inc.
 - j. Seal N Kure FDR; Metalcrete Industries.

- k. Rich Cure; Richmond Screw Anchor Co.
- l. Resi-Chem C309; Symons Corporation.
- m. Horncure 30; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
- n. Uni Res 150; Unitex.
- o. Certi-Vex RC; Vexcon Chemicals, Inc.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, ½" wide asphalt-saturated cellulosic fiber, with "Void Cap" by Superior Featherweight Tools Co., Inc. (phone: 800-423-1521), or equal as approved by Architect.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type: Class II, non-load bearing, for bonding freshly mixed to hardened concrete.
 - 2. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
 - 1. Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: 3 inches.
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:

1. Air Content: 6.5 percent for 3/4-inch maximum aggregate.

G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

B. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 3. Provide tie bars at sides of pavement strips where indicated.
 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 1. Locate expansion joints at intervals of 40 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 3/8 inch.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 3/8 inch.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing

operations or spreading dry-shake surface treatments.

- I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- J. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture-retaining-cover curing where precast concrete pavers are bonded to recessed slabs, and curing compound where the cast in place concrete is the final surface.
 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

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

- B. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- C. Testing Services: Testing shall be performed according to the following requirements:
1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
 5. Compression Test Specimens: ASTM C 31/C 31M; one set of three standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 20 cu. yd., plus one set for each additional 20 cu. yd.. One specimen shall be tested at 7 days and one specimen at 28 days; one specimen shall be retained in reserve for later testing if required.
 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Owner, Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.
- F. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 06105 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Wood blocking and nailers.
2. Wood furring and grounds.
3. Plywood panels.
4. Rooftop equipment bases and support curbs.

- B. Related Sections include the following:

1. Division 6 Section "Laboratory Casework" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.
 4. Powder-actuated fasteners.
 5. Expansion anchors.
 6. Metal framing anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWWPA C20 (lumber) and AWWPA C27 (plywood).
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
 - 3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - 4. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat all miscellaneous carpentry, unless otherwise indicated.
 - 1. Concealed blocking.
 - 2. Plywood panels.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
 - 4. Grounds.
 - 5. Plywood panels.
 - 6. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.

2.4 PLYWOOD PANELS

- A. Telephone, Electrical Equipment Backing Panels and plywood sheathing for roof construction: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

- D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
- G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06105

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Laminate-clad cabinets (plastic-covered casework).
 - 2. Engineered Quartz Countertops.
 - 3. Cabinetry Hardware and Accessories.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

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 and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
- D. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminates.
2. Solid surfacing.

E. Samples for verification of the following:

1. Laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
2. Thermoset decorative-overlay surfaced panel products, 8 by 10 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
3. Exposed cabinet hardware, one unit for each type and finish.

F. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.
2. The Contract Documents contain selections chosen from options in the Quality Standard as well as additional requirements beyond those of the Quality Standard. Comply with such selections and requirements in addition to the Quality Standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
 - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Coordinate cabinet shop drawings and fabrication with hardware requirements as specified in Cabinet Hardware and Accessory Schedule found at the end of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:
- B. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade indicated, unless otherwise indicated.
 - 1. Hardboard: AHA A135.4.
 - 2. Multi-core panels.
 - 3. Softwood Plywood: PS 1.
 - 4. Hardwood Plywood and Face Veneers: HPVA HP-1.

C. Formaldehyde Emission Levels:

1. For Medium-Density Fiberboard: Comply with requirements of NPA 9.
2. For Particleboard: NPA8
3. For Hardwood Plywood: HPMA FE

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Formica Corporation.
 - b. Pionite.
 - c. Nevamar Corp.
 - d. Ralph Wilson Plastics Co.

E. Engineered quartz countertops: Factory-molded 93% min. quartz and acrylic with smooth finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cambria.
 - b. Ceaser Stone.
 - c. Silestone.
 - d. Zodiac.
2. Physical Properties:
 - a. Flexural Strength: Not less than 7,420 psi.
 - b. Modulus of Elasticity: Not less than 2,000,000 psi.
 - c. Hardness (MOHS): Not less than 6.5.
 - d. Water Absorption (24 Hours): Not more than 0.022 percent.
3. Stain and Acid Resistance:ASTMD2299 :
 - a. Not effected.
4. Color: As selected from full range, regardless of price grade.

F. Adhesive for Bonding Plastic Laminate: Contact cement.

G. Thermo-fused Melamine to Multi-core Panel.

1. Melamine thermo-fused to multi-core panel substrate. White colored melamine shall be standard for all cabinet interiors whether exposed or semi-exposed.

2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General: Provide cabinet hardware and accessory materials associated with architectural

cabinets, except for items specified in Division 8 Section "Door Hardware."

- B. Cabinet Hardware Schedule: Refer to schedule at end of this Section for cabinet hardware required for architectural cabinets.
- C. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Satin Stainless Steel: BHMA 632 for stainless steel base.
- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.
- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.
- F. Counter Supports for Bathrooms: Shall be 1-1/4" stainless steel tubing as indicated in construction documents.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.
 - 1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
 - 1. Grade: Premium.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in

installation areas.

- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid-wood (lumber) members and rails: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.
- E. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

2.5 LAMINATE-CLAD CABINETS (PLASTIC COVERED CASEWORK)

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate-clad cabinets.
 - 1. Grade: Premium.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Casework Bases: Provide 4 inch high continuous base, without plastic laminate, for all floor mounted casework.
- D. Drawers: Construct drawers with 5/8" thick plyon or equal. Provide premium grade joint construction, and low pressure laminate faced 1/4" inch thick composition board bottoms let into sides, back and front. Drawer fronts shall be mounted with an adjusting mechanism to allow full adjustability and alignment in the field.
- E. Cores: Sides, tops bottoms, doors, drawer fronts, and partitions shall have thermo-fused melamine on 3/4-inch thick multi-core premium grade panel product cores manufactured for use as a core material for laminated casework. Provide 1-inch thickness for bottom panel of wall hung units (same as shelves) and 1" thick for spans between 30" and 42 ".
 - 1. Multi-core Panel Products:
 - a. "Simpson Plyon", Simpson.
 - b. "Comply", Weyerhaeuser.

- c. "Multicore", Weldwood.
 - d. "Or other acceptable (as judged by the Architect) comparable product.
 - F. Shelf Cores: Shelves shall have same core material as specified for the cabinet body except in thickness of 1-inch. Particle board core will not be acceptable.
 - 1. Fixed shelving within casework shall be let into or doweled into sides.
 - G. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements.
 - 1. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch nominal thickness.
 - 2. Vertical Surfaces: GP-50, 0.050-inch nominal thickness.
 - 3. Edges: 3 mm PVC tape, 0.018-inch minimum thickness matching laminate in color, pattern, and finish unless noted otherwise.
 - 4. Post formed Surfaces: PF-42(0.042-inch nominal thickness)
 - H. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other than Drawer Bodies: High-pressure decorative laminate.
 - I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes:
 - J. Edge Banding:
 - 1. Edge banding for cabinet body parts shall be purified 3mm PVC applied with hot melt glue by automatic edge-banding equipment. Color shall be as selected by architect from manufacturers full color range.
 - 2. Edge banding for door and drawer fronts shall be purified 3mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with 3mm radius and scraped free from machining or chatter marks. Color shall be as selected by architect from manufacturers full color range.
- 2.6 SOLID SURFACING MATERIAL COUNTER TOPS.
- A. Fabrication: Fabricate in one piece with shop-applied edges, unless otherwise indicated. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing.
 - B. Solid Surfacing Material Thickness: 1/2 inch.
 - C. Colors, Matrix Patterns, and Finishes: Provide materials and products that result in colors of solid surface material complying with the following requirements:
 - 1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches for plumb and level (including tops).
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
- F. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c.
- G. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.
- H. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

- A. BHMA numbers are used below to designate hardware requirements, except as otherwise indicated.
- B. Concealed (European Type) Hinges: Blum 170 degree w/ mounting plate; #71.6500
- C. Pulls: as indicated in construction documents:
 - 1. Wire Pulls: 4" chrome wire pulls
- D. Shelf Rests: 5mm Steel Shelf Supports- KV #346 or Blum #34,0040.
- E. Drawer Slides: Accuride: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA A156.9, Grade 1 and rated for the following loads:
 - 1. Box and pencil Drawer Slides: 100 lb, Blum BS230, Bottom mount, full extension, white.
 - 2. File Drawer Slides: Accuride full extension progressive drawer guide, 150 lb. Bs430.
- F. Door and Drawer Locks: National # C - 80 series. Keyed alike

END OF SECTION 06402

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Interior joints in vertical surfaces as indicated below:

a. Joints as indicated.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

E. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

F. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.7 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

- A. **Elastomeric Sealant Standard:** Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
 - 1. **Additional Movement Capability:** Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.
- B. **Products:** Subject to compliance with requirements, provide one of the products specified in each Elastomeric Joint Sealant Data Sheet.

2.3 JOINT SEALANT BACKING

- A. **General:** Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. **Plastic Foam Joint Fillers:** Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
 - 2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
 - 3. Any material indicated above.
- C. **Elastomeric Tubing Joint Fillers:** Neoprene, butyl, EPDM or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to 26 deg. F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. **Bond-Breaker Tape:** Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.**MISCELLANEOUS MATERIALS**
- E. **Primer:** Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- F. **Cleaners for Nonporous Surfaces:** Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

- G. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.6 ELASTOMERIC JOINT SEALANT DATA SHEET

A. Elastomeric Joint Sealant Designation: Multi-part non-sag urethane sealant

1. Base Polymer: Urethane.
2. Type: M (Multi component).
3. Grade: NS (nonsag).
4. Class: 25.
5. Additional Movement Capability: 50 percent movement in extension and 50 percent in compression for a total of 100 percent movement.
6. Use Related to Exposure: NT (nontraffic).
7. Uses Related to Joint Substrates: M, G, A, and , as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Color anodized aluminum, aluminum coated with a high-performance coating, galvanized steel, ceramic tile.
8. Products:
 - a. "Dynatrol II", Pecora Corp.
 - b. "Vulkem 922", Mameco.
 - c. "Sonolastic NP2", Sonneborn Building Products Division.

B. Elastomeric Joint Sealant Designation: One part mildew resistant silicone

1. Base Polymer: Acid-curing silicone.
2. Type: S (single component).
3. Grade: NS (nonsag).
4. Class: 25.
5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Coated glass, color anodized aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and ceramic tile.
7. Products:
 - a. "786 Mildew Resistant", Dow Corning.
 - b. "Sanitary 1700", GE Silicones.

C. Elastomeric Joint Sealant Designation: Acrylic-Emulsion Sealant

1. Base Polymer: Acrylic -Emulsion Sealant.
2. Type: S (single component).
3. Grade: NS (nonsag).
4. Class: 25.
5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated

7. Products:

- a. "AC-20," Pecora Corp.
- b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
- c. "Tremco Acrylic Latex 834," Tremco, Inc.

3.7 ELASTOMERIC JOINT SEALANT SCHEDULE

JOINT SEALERS	DESCRIPTION OF JOINT CONSTRUCTION AND LOCATION WHERE SEALANT IS TYPICALLY APPLIED*.
One-Part Pourable Urethane Sealant	Exterior and interior joints in horizontal surfaces of concrete.
Multi-Part Nonsag Urethane Sealant	Exterior and interior joints in vertical surfaces of concrete; between metal and concrete or mortar; interior and exterior perimeter joints of metal frames in exterior walls; exterior overhead joints.
Acrylic-Emulsion Sealant	Interior joints in field-painted vertical and overhead surfaces at perimeter of hollow metal door and window frames; in gypsum drywall, concrete, and concrete masonry; and all other interior joints not indicated otherwise.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal frames.
- B. Related Sections
 - 1. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
 - 2. Division 9 Sections "Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 2. Locations of reinforcement and preparations for hardware.
 - 3. Details of each different wall opening condition.
 - 4. Details of anchorages, joints, field splices, and connections.
 - 5. Details of accessories.
 - 6. Details of moldings, removable stops, and glazing.
 - 7. Details of conduit and preparations for power, signal, and control systems.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benchmark; a division of Therma-Tru Corporation.
 - 2. Deansteel Manufacturing Company, Inc.
 - 3. Habersham Metal Products Company.
 - 4. Kewanee Corporation (The).
 - 5. Mesker Door Inc.
 - 6. Pioneer Industries, Inc.
 - 7. Steelcraft; an Ingersoll-Rand company.
 - 8. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Frames for Wood Doors: 16 gauge steel sheet for openings 4' or less.
 - 2. Frames for Wood Doors: 14 gauge steel sheet for openings more than 4'.
 - 3. Frames for borrowed lights: 16 gauge steel sheet.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117 .

C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

4. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.

2) Four anchors per jamb from 60 to 90 inches high.

3) Five anchors per jamb from 90 to 96 inches high.

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

b. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

5. Door Silencers: Except on weather-stripped or smoke-seal openings, drill frame stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

- D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 .
 - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

2.6 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural

- support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer, faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.
- D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UBC Standard 7-2.
 1. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Buell Door Company.
 - c. Chappell Door Co.
 - d. Eggers Industries; Architectural Door Division.
 - e. GRAHAM Manufacturing Corp.
 - f. Haley Brothers, Inc.
 - g. Ideal Wood Products, Inc.
 - h. IPIK Door Company.
 - i. Mohawk Flush Doors, Inc.
 - j. Oshkosh Architectural Door Co.
 - k. VT Industries Inc.
 - l. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Adhesives: Do not use adhesives containing urea formaldehyde.
- B. Doors for Transparent Finish:
 1. Grade: Premium, with Grade AA faces.
 2. Species and Cut: Red oak, plain sliced.
 3. Match between Veneer Leaves: Book match.
 4. Assembly of Veneer Leaves on Door Faces: Balance match.
 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 20 feet or more.
 7. Stiles: Same species as faces.

2.3 SOLID-CORE DOORS

- A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.
 - a. Use particleboard made with binder containing no urea-formaldehyde resin.
2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 4-1/2-by-10-inch lock blocks 5-inch midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.4 LOUVERS AND LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch-thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated.

2.5 FABRICATION

- A. Fabricate doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Finish doors at factory.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: AWI System TR-6 catalyzed polyurethane.
 3. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-6 catalyzed polyurethane .
 4. Staining: As selected by Architect from manufacturer's full range.
 5. Effect: Open-grain finish.
 6. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
 - b. Other doors to the extent indicated.
 - 2. Cylinders for doors specified in other Sections.
 - 3. Electrified door hardware.
- B. Related Sections include the following:
 - 1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
 - 2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.3 SUBMITTALS

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

- a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - 1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.
 1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
 1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.
- F. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.
- G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Supplier Qualifications:** Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. **Electrified Door Hardware Supplier Qualifications:** An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - a. **Engineering Responsibility:** Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 2. **Scheduling Responsibility:** Preparation of door hardware and keying schedules.
- C. **Architectural Hardware Consultant Qualifications:** A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 - 1. **Electrified Door Hardware Qualifications:** Experienced in providing consulting services for electrified door hardware installations.
- D. **Source Limitations:** Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.
- E. **Regulatory Requirements:** Comply with provisions of the following:
 - 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, as follows:
 - a. **Handles, Pulls, Latches, Locks, and other Operating Devices:** Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. **Door Closers:** Comply with the following maximum opening-force requirements indicated:
 - 1) **Interior Hinged Doors:** 5 lbf applied perpendicular to door.
 - 2) **Fire Doors:** Minimum opening force allowable by authorities having jurisdiction.
 - c. **Thresholds:** Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf 67 N to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
 - c. Thresholds: Not more than 1/2 inch high.
 3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: Test at atmospheric pressure.
- G. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to electrified door hardware including, but not limited to, the following:
1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 2. Review sequence of operation for each type of electrified door hardware.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices.
- C. WARRANTY

- D. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- E. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- F. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
- G. Warranty Period for Electromagnetic Locks: Five years from date of Substantial Completion.
- H. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

1.8 EXTRA MATERIALS

- A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hardware: one each passage latch sets, keyed lock sets, lock cylinder
 - 2. Electrical Parts: one each magnetic hold open, operator, actuator, strike

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products, products equivalent in function and comparable in quality to named products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES AND PIVOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hinges:
 - a. Baldwin Hardware Corporation (BH).
 - b. Bommer Industries, Inc. (BI).
 - c. Hagger Companies (HAG).
 - d. Lawrence Brothers, Inc. (LB).
 - e. McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).
 - f. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
 - g. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

B. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.

C. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

D. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

E. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.

2. Interior Hinges: Steel, with steel pin.
3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

F. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - a. Outswinging exterior doors.
 - b. Outswinging corridor doors with locks.

2. Corners: Square.

G. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:
 - a. Best
 - b. Corbin
 - c. Sargent
 - d. Schlage
 - e. Yale

B. Standards: Comply with the following:

1. Bored Locks and Latches: BHMA A156.2.
2. Mortise Locks and Latches: BHMA A156.13.
3. Interconnected Locks and Latches: BHMA A156.12.
4. Auxiliary Locks: BHMA A156.5.
5. Push-Button Combination Locks: BHMA A156.2.
6. Electromagnetic Locks: BHMA A156.23.
7. Delayed-Egress Locks: BHMA A156.24.
8. Exit Locks: BHMA A156.5.

C. Bored Locks: BHMA Grade 1; Series 4000.

D. Certified Products: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

- E. Lock Trim: Comply with the following:
 - 1. Lever: Wrought, forged, or cast.
 - 2. Escutcheon (Rose): Wrought, forged, or cast.
 - 3. Dummy Trim: Match lever lock trim and escutcheons.
 - 4. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:
- F. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:
 - 1. Bored Locks: BHMA A156.2
- G. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- H. Rabbeted Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.
- I. Backset: 2-3/4 inches, unless otherwise indicated.

2.4 CYLINDERS AND KEYING

- A. Coordinate with Owner for cylinders and keys for locksets.

2.5 STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

2.6 CLOSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Surface-Mounted Closers:
 - a. LCN Closers; an Ingersoll-Rand Company (LCN). (required to match existing bldg.)
- B. Standards: Comply with the following:
 - 1. Closers: BHMA A156.4.

- C. Surface Closers: BHMA Grade 1
- D. Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."
- E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.7 PROTECTIVE TRIM UNITS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Protective Trim Units:
 - a. Baldwin Hardware Corporation (BH).
 - b. Hager Companies (HAG).
 - c. Ives: H. B. Ives (IVS).
 - d. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
 - e. Rockwood Manufacturing Company (RM).
 - f. Triangle Brass Manufacturing Company, Inc. (TBM).
- C. Standard: Comply with BHMA A156.6.
- D. Materials: Fabricate protection plates from the following:
 - 1. Stainless Steel: 0.050 inch thick; beveled top and 2 sides.
- E. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.
- F. Furnish protection plates sized 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in Door Hardware Schedule.

2.8 STOPS AND HOLDERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Baldwin Hardware Corporation (BH).
 - 2. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - 3. Hager Companies (HAG).
 - 4. Ives: H. B. Ives (IVS).
 - 5. LCN Closers; an Ingersoll-Rand Company (LCN).
 - 6. Norton Door Controls; Div. of Yale Security Inc. (NDC).

7. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
8. Rockwood Manufacturing Company (RM).
9. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
10. Triangle Brass Manufacturing Company, Inc. (TBM).

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Mechanical Door Holders: BHMA A156.16.
3. Electromagnetic Door Holders: BHMA A156.15.
4. Combination Overhead Holders and Stops: BHMA A156.8.
5. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.

D. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide overhead holders.

2.9 MISCELLANEOUS DOOR HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Baldwin Hardware Corporation (BH).
2. Hager Companies (HAG).
3. Ives: H. B. Ives (IVS).
4. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
5. Rockwood Manufacturing Company (RM).
6. Triangle Brass Manufacturing Company, Inc. (TBM).

B. Standard: Comply with the following:

1. Auxiliary Hardware: BHMA A156.16.
2. Exit Alarms: BHMA A156.5.

C. Auxiliary Hardware: BHMA Grade 1, unless otherwise indicated.

2.10 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a

quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 - 3. Steel Through Bolts (sex bolts): For the following fire-rated applications, unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
 - 4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
 - 5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.11 FINISHES

- A. Standard: Comply with BHMA A156.18.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
 - 1. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
 - 2. BHMA 630: Satin stainless steel, over stainless-steel base metal.
 - 3. BHMA 652: Satin chromium plated over nickel, over steel base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.
- B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
 - 1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
 - 2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
 - 3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE

HFS Architects
DFCM #07211370
HFSA #0740.01

Promontory Hall
HVAC Upgrade
Utah State Fairpark

NO.	QTY.	ITEM	MFG	MODEL	STYLE/SIZE	FINISH
1		Mechanical Room				
	6 Ea	Hinges	Hager	AB700	4 ½ "x 4 ½ "	26D
	1 Ea	Lockset	Schlage*	D50PD	Rhodes	26D
	1 Set	Manual Bolts	Glynn Johnson	FB6		26D
	2 Ea	Stop	Quality	W302	-----	26D

END OF SECTION 08711

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Nonload-bearing steel framing members for gypsum board assemblies.
 - 2. Repairs to original gypsum board assemblies

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

- A. Fire Resistance: Provide gypsum board assemblies with fire-resistance ratings indicated.

1.5 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.
- C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
- B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
 - 1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.
 - 1. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Framing and Furring:

- a. Consolidated Systems, Inc.
- b. Dale Industries, Inc.
- c. Dietrich Industries, Inc.
- d. Marino/Ware (formerly Marino Industries Corp.).
- e. National Gypsum Co.; Gold Bond Building Products Division
- f. Unimast, Inc.

2. Gypsum Board and Related Products:

- a. Domtar Gypsum.
- b. Georgia-Pacific Corp.
- c. Georgia-Pacific Corp.
- d. National Gypsum Co.; Gold Bond Building Products Division.
- e. United States Gypsum Co.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components complying with ASTM C 754 for conditions indicated.

1. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.062 inch thick.
2. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch diameter.
 - a. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.
3. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch- wide flanges, and as follows:
 - a. Carrying Channels: 2 inches deep, 590 lb/1000 feet, unless otherwise indicated.
 - b. Furring Channels: 3/4 inch deep, 300 lb/1000 feet, unless otherwise indicated.
 - c. Finish: ASTM A 653, G 60 (ASTM A 653M, Z 180) hot-dip galvanized coating for framing for exterior soffits and where indicated.
4. Steel Studs for Furring Channels: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 - a. Thickness: 20 gage, unless otherwise indicated, except at door jambs where 16 gage is required.
 - b. Depth: 3-5/8 inches and 6 inches unless otherwise indicated.
 - c. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating.
5. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
 - a. Thickness: 25 gage, unless otherwise indicated.
 - b. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating.

2.3 STEEL FRAMING FOR WALLS, PARTITIONS AND SOFFITS

- A. General: Provide steel framing members complying with the following requirements:
1. Protective Coating: Manufacturer's standard corrosion-resistant coating.
 2. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 - a. Thickness: 20 gage, unless otherwise indicated.
 - b. Thickness: 16 gage, as follows:
 - 1) For jamb studs at doors and other openings, continue to structure above.
 - c. Depth interior: 3-5/8 and 6 inches at interior, unless otherwise indicated.
 3. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:
 - a. Thickness: 25 gage, unless otherwise indicated.
 - b. Depth: 7/8 inch.
 4. Steel Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M), length and width as indicated, and with a minimum base metal (uncoated) thickness as follows:
 - a. Thickness: 0.027 inch unless indicated otherwise.
 5. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
1. Widths: Provide gypsum board in widths of 48 inches.
 2. Gypsum Wallboard: ASTM C 36 and as follows:
 - a. Type: Regular for vertical surfaces, unless otherwise indicated.
 - b. Type: Type X where required for fire-resistance-rated assemblies.
 - c. Type: Sag-resistant type for ceiling surfaces.
 - d. Edges: Tapered and featured (rounded or beveled) for prefilling.
 - e. Thickness: 5/8 inch, unless otherwise indicated.

2.5 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
 - 1. Material: Formed metal complying with the following requirement:
 - a. Steel sheet zinc coated by hot-dip process or rolled zinc.
 - b. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - 1) Cornerbead on outside corners, unless otherwise indicated.
 - 2) LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.

2.6 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
 - 1. Use pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 - 1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
 - 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
 - 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
 - 4. For topping compound, use sandable formulation.
- D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
 - 1. Ready-Mixed Formulation: Factory-mixed product.
 - a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
 - b. Topping compound formulated for fill (second) and finish (third) coats.
 - c. All-purpose compound formulated for both taping and topping compounds.

2.7 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
 - 1. Steel drill screws complying with ASTM C 1002 for the following applications:
 - a. Fastening gypsum board to steel members less than 0.033 inch thick.
 - 2. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
 - 2. Where partition framing and wall furring abut structure, except at floor.

- a. Install deflection track top runner to attain lateral support and avoid axial loading.
3. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR WALLS AND CEILINGS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 1. Cut studs 1/2 inch short of full height to provide perimeter relief.
- D. Terminate partition framing 6" above suspended ceilings where indicated.
- E. Install steel studs and furring in sizes and at spacings indicated.
 1. Single-Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.
- F. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- G. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 1. Install 2 studs at each jamb, unless otherwise indicated.
 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.5 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.
- E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- F. Attach gypsum panels to framing provided at openings and cutouts.
- G. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- I. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.

3.6 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels **vertically** (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
3. Single-Layer Fastening Methods: Apply gypsum panels to supports with screws.

3.7 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install cornerbead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
- D. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
- D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 2. Level 2 where panels form substrates for tile and where indicated.
 3. Level 4 for gypsum board surfaces, unless otherwise indicated.
- E. Use one of the following joint compound combinations as applicable to the finish levels specified:
 1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.

2. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.

F. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.

G. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.

H. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.

3.9 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed interior items and surfaces.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Unless otherwise noted, do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Finished mechanical and electrical equipment.
 - b. Light fixtures.
 - c. Distribution cabinets.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Utility tunnels, except for gas pipe, which shall be painted.
 - d. Pipe spaces.
 - e. Duct shafts.
 - 3. Finished metal surfaces include the following:

- a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Architectural Copper.
 - e. Architectural Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
- a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
1. After color selection, the Architect will furnish color chips for surfaces to be coated.

- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
 3. Submit Samples on the following substrates for the Architect's review of color and texture only:
 - a. Concrete: Provide two 4-inch- square samples for each color and finish.
 - b. Ferrous Metal: Provide two 4-inch- square samples of flat metal and two 8-inch- long samples of solid metal for each color and finish.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
 - 1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
 - 1. PPG Industries, Inc. (PPG).
 - 2. Pratt & Lambert, Inc. (P & L).
 - 3. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond or the surface smoothness of the various coatings. Remove oil, grease, adhered dirt, dust and debris before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

- D. **Materials Preparation:** Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. **Tinting:** Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. **General:** Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Sand lightly between each succeeding enamel or varnish coat.
- B. **Scheduling Painting:** Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Ducts work.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 INTERIOR PAINT SCHEDULE

- A. Gypsum Board and existing Plaster: Provide the following finish systems over interior gypsum board and existing plaster surfaces:
 - 1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) PPG:17-10 Quick-Drying Interior Latex Primer-Sealer.
 - 2) P & L:Z/F 1004 Suprime "4" Interior Latex Wall Primer.
 - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
 - 1) PPG:89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
 - 2) P & L:Z/F 4000 Series Accolade Interior Velvet.
- B. Ferrous Metal: Provide the following finish systems over ferrous metal:
 - 1. Semigloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

- a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
 - 1) PPG:6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 2) P & L:S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
 - 3) S-W:Kem Kromik Metal Primer B50N2/B50W1.

- b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) PPG:6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
 - 2) P & L:S/D 1011 Suprime "11" Interior Alkyd Wood Primer.
 - 3) S-W:ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.

- c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.
 - 1) PPG:27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
 - 2) P & L:S/D 5700 Cellu-Tone Alkyd Satin Enamel.
 - 3) S-W:Classic 99 Interior/Exterior Semi-Gloss Alkyd Enamel A-40 Series.

END OF SECTION 09912

**PROMONTORY HALL HVAC UPGRADE
UTAH STATE FAIRPARK**

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SECTION 15030 SYSTEM COMMISSIONING

PART 1 - GENERAL

DESCRIPTION:

The work required under this section shall be done by the same firm which is providing system balancing services under section 15043. The work shall include, but not necessarily be limited to, the following:

The pre-startup inspection of all systems and subsequent correction of any incorrect items.

The initial first run inspections.

System operations inspection.

The intent of this section is to provide for proper installation, startup, service, and operation of the mechanical systems in preparation for system balancing. See Section 15043 for balancing. After completion of the balancing, the mechanical system shall be ready for Owner occupancy, with all systems operating as intended.

Repair, replacement, or adjustment of each item shall be performed for startup.

All pertinent items shall be checked, including, but not necessarily limited to, the following:

1. Removal of shipping stops.
2. Vibration isolators properly aligned and adjusted.
3. Flexible connections are properly aligned.
4. Belts are properly adjusted.
5. Belt guards and safety shields are in place.
6. All systems are properly filled.
7. Filters are in place with a proper seal around their edges.
8. Fire dampers are properly installed, linked, and serviceable.
9. Pressure and temperature gauges of the proper size and range are installed.
10. All test stations and measuring devices are installed and functioning.
11. Initial lubrication of equipment is complete.
12. Filters and strainers are clean.
13. Motor rotations are correct.
14. Voltages match nameplates.
15. Control system is operating properly.
16. All interlocks are wired and verified.
17. All controls have been connected and verified.

18. All valves, dampers, and operators are properly installed and operating.
19. All ductwork is installed and connected.
20. All roof-mounted equipment is properly flashed.
21. All water piping is located in spaces which are heated to prevent freezing.
22. All other items necessary to provide for proper start-up.
23. All equipment installed properly.

FIRST RUN INSPECTION:

Recheck all items outlined in pre-startup inspection to insure proper operation.

Check the following items:

1. Excessive vibration or noise.
2. Loose components.
3. Initial control settings.
4. Motor amperages.
5. Heat buildup in motors, bearings, etc.
6. Control system is properly calibrated and functioning as required. Correct all items which are not operating properly.

SYSTEM OPERATION INSPECTION:

The mechanical systems shall be observed under operation conditions for sufficient time to insure proper operation under varying conditions, such as daylight and heating-cooling.

Periodically check the following items:

1. Strainers and filters.
2. Visual check of air flow for "best guess" setting for preparation for system air balancing under Section 15043.
3. Control operation of time clocks, on-off sequences, system cycling, etc.
4. Visual checks for water flow, seals, packings, safety valves, operating pressures and temperatures.
5. Cleaning of excessive oil or grease.
6. Dampers close tightly.
7. Valves close tightly.
8. System leaks.
9. All other items pertaining to the proper operation of the mechanical system, whether specifically listed or not.

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DFCM #07211370
HFSA #0740.01**

**Promontory Hall
HVAC Upgrade
Utah State Fairpark**

WARRANTY SCHEDULE:

Provide a list in each O & M manual for all motors, fans, and equipment with serial numbers and date of startup approved by the Owner's Representative, date of warranty, extend of warranty, and equipment supplier with address and phone numbers.

SCHEDULE OF OVERLOAD PROTECTION:

Provide a list in each O & M Manual of all motors with size, voltage, amperage, and size and rating of overload protection.

CERTIFICATION:

Provide written certification of all tests, and start-up procedures as directed by the owner's representative and bind a copy of this certification in the O & M manuals. Certification shall include an itemized list of systems serviced during the system commissioning process for each piece of equipment with dates, times, and a complete description of the work completed. All reports shall bear the typed name and signature of the system commissioning mechanic.

SECTION 15042 - TESTING

PART 1 - GENERAL

DESCRIPTION:

The work outlined in this section shall be performed by the several trades involved.

The mechanical contractor shall provide all supervision, labor, materials, tools, scaffolding, and equipment required to complete all system testing.

The mechanical contractor shall remove and repair any defective component, as indicated by the system tests and retest.

The contractor shall test the operation of all safety and high limit controls to insure proper installation and operation. Any defective devices shall be replaced.

TESTS AND ADJUSTMENTS:

Before any piping is covered, tests shall be made in the presence of the Owner's representative and any leaks or defective work corrected.

Before application of insulation covering, and as far as practical before concealing any piping, all piping shall be hydrostatically tested and proved tight. Stubs shall be capped and all control valves shall be removed during the test. System may be tested in sections, providing connections to last section tested are included in each succeeding test. Following minimum pressures shall be used for testing:

1. Low pressure air ducts in accordance with SMACNA standards.
2. Refrigeration piping, as indicated in Section "Refrigeration Piping Installation".

All valves and equipment which may be damaged shall not be subjected to the test pressure.

PART 2 - PRODUCTS

EQUIPMENT:

The contractor shall furnish all necessary gauges, plugs, test fans, pumps, etc., as required, to conduct the tests.

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REPORTS:

The contractor shall give the Owner's representative one week notice prior to performing the tests. All tests shall be recorded and copies of reports bound in the O & M manuals and given to the Owner.

PART 3 - EXECUTION

PROCEDURE:

The contractor shall be responsible to conduct all tests in a safe manner, protecting the work of other trades from water or physical damage.

The tests, as indicated, shall be in addition to any test, as required, by any governing agencies. Submit all approved test procedures and results, as required by governing agencies to the Owner's Representative.

All tests, necessary repairs, and retest, shall be performed by the contractor which installed the system.

SECTION 15043 - BALANCING

PART 1 - GENERAL

SCOPE OF WORK:

The mechanical contractor shall employ an independent technical firm to perform the checking, adjusting, and balancing (CAB) of the air conditioning systems. See Section 15030 for related work by the CAB contractor. This firm shall be one whose operations are limited to the field of professional CAB, and this firm shall meet the following qualifications:

1. The firm shall be a member of AABC or NEBB, and shall be one which is organized to provide professional services of this specific type.
2. The firm shall be capable of performing the services within the time frame specified, and following up the basic work as may be required.
3. All personnel used on the job site shall be engineering technicians, who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to the start of the work for this project.

As a part of this contract, the mechanical contractor shall make all changes in the sheaves, belts, and dampers, including the addition of dampers required for correct balance, as required by the CAB firm, at no additional cost to the Owner.

The mechanical contractor shall provide and coordinate services of qualified, responsible subcontractors, suppliers, and personnel, as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting, and balancing period.

In order that all systems may be properly checked, balanced, and adjusted, as required herein by these specifications, the mechanical contractor shall, after the systems have been properly commissioned, operate said systems at his expense for the length of the time necessary to properly verify their completion and readiness for the CAB and shall further pay all costs of operation during the CAB period.

Project contract completion schedules shall provide sufficient times to permit the completion of CAB services prior to Owner occupancy.

DOCUMENTS:

The Owner's Representative will furnish, without charge to the CAB firm, one set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of plans less the structural sheets.
2. One set of mechanical floor plans of the conditioned spaces.

These sheets should be ozalid type (blue or black on light background) reproductions to facilitate marking.

Approved submittal data on equipment installed to accomplish the test procedures outlined in paragraph "Services to the CAB Firm" of this specification will be provided by the mechanical contractor.

The Owner's representative shall transmit one copy of the following "Records for Owner" to the CAB firm for review and comments:

1. Record drawings
2. Approved fixture brochures, wiring diagrams, and control diagrams
3. Shop drawings
4. Instructions
5. Motor and valve charts
6. Operating and maintenance manuals

MATERIALS AND WORKMANSHIP:

The scope of the CAB work, as defined herein, is indicated in order that this project's mechanical contractors will be appraised of the coordination, adjustment, and system modification which will be required under the project in order to complete the Owner's requirements for final CAB. The CAB firm will have a contractual relationship with this mechanical contractor, but will be responsible directly to the Owner for the satisfactory execution of the CAB work.

SERVICES OF MECHANICAL CONTRACTOR:

The mechanical contractor shall have all systems complete, calibrated, commissioned, and in operational readiness prior to notifying the CAB firm that the project is ready for their services, and the contractor shall so certify in writing to the Owner that such a condition exists.

Should the CAB firm be so notified and the CAB work commenced and the systems are found to not be in readiness or a dispute occurs as to the readiness of the systems, the mechanical contractor shall request an inspection be made by a duly appointed representative of the Owner, CAB firm, and the mechanical contractor. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for CAB services. Should the inspection reveal the CAB services notification to have been premature, all costs of the inspection and work previously accomplished by the CAB firm shall be paid for by the project mechanical contractor.

SERVICES OF THE CAB FIRM:

The technical CAB firm shall submit biographical data on the individual proposed to directly supervise the CAB work, it shall also submit their record of specialized experience in the field of air and hydronic system balancing, proper use of calibrated instrumentation and the manner of test reports. The supervisory personnel for the CAB firm shall be registered engineers in the mechanical field and all of the employees used in the CAB firm shall be permanent, full-time employees of the firm.

Act as liaison between the Owner, Owner's Representative, and contractor and inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning, and ventilating systems. The inspection of the work will cover that part relating to proper arrangement and adequate provisions for the checking and balancing.

Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions on each conditioned space in the building.

Prepare and submit to the Owner (or his delegated representative) complete reports on the balance and operations of the systems.

Make a total of three inspections within ninety (90) days after occupancy of the building to insure that satisfactory conditions are being maintained throughout and to satisfy any unusual conditions.

Make an inspection in the building during the opposite season from that in which the initial adjustments were made at that time, make any necessary modifications to the initial adjustment required to product optimum operation of the system components, to produce the proper conditions in each conditioned space.

The CAB firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of the following general systems, including all components:

1. Cooling systems, including DX coils, condensing units, controls, etc.
2. Air distribution systems including Air Handling unit, ductwork, dampers, diffusers, registers, grilles, etc.
3. Temperature control system in its entirety, including the verification of all control sequences and verify devices.

Before any adjustments are made, the air systems are to be checked for such items as dirty filters, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc.

It shall be the responsibility of the CAB personnel to check, adjust, and balance the components of the various systems as listed above using an applicable "proportionate balance procedure" in order that each of them will operate under optimum noise, temperature and air flow conditions in the conditioned spaces in the building "while simultaneously operating at the most energy efficient condition."

During the balancing process, if abnormalities or malfunctions of equipment or components are discovered by the CAB personnel, the construction inspector shall be advised promptly so that the condition may be corrected by the project contractor. Data from malfunctioning equipment or components shall not be recorded in the final CAB report.

PART 2 - PRODUCTS

EQUIPMENT AND INSTRUMENTS:

This contractor shall provide all necessary labor, equipment, scaffolding, instruments, and materials required to adjust, balance, and check all systems.

PART 3 - EXECUTION

REPORT:

The activities, as described hereinbefore, will culminate in a report to be provided to the Owner or his delegated representative. This report shall be furnished in six (6) copies. One copy shall be bound in each O & M manual. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operating personnel.

All measurements and recorded readings (of air, electricity, etc.) that appear in the reports must be done on-site by the permanently employed technicians of the firm.

At the option of the Owner's Representative, all data sheets tabulated each day by CAB personnel may be initialed by the Owner's Representative. Those work sheets so initialed, or copies thereof, shall be included in the final CAB report.

The CAB report shall include the following as a minimum:

Preface:

A general discussion of the system, any idiosyncrasies, any problems encountered, an outline of normal and ventilation cycles of operation, any noise problem not corrected.

Pitot Tube Traverses:

For use in future trouble-shooting by maintenance personnel, all exhaust ducts, main supply ducts, and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.

Temperature Tabulation:

Of all conditioned spaces on a room-by-room basis, a total of at least three readings will be taken of each room on successive days. Record outside ambient temperature at two-hour intervals. The total variation in conditioned space temperatures shall not exceed 2 deg. variance from the thermostat settings.

Air Volumes and Velocities:

As measured at each supply grille, return air grille, and exhaust air grille or air handling device. In all fan systems, the air quantities indicated on the plans may be varied, as required, to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the contractor to furnish or revise fan drive and/or motors, if necessary, without cost to the Owner, to attain the specified air volumes.

Air Pressure:

As measured across each furnace, DX coil, filter and exhaust fan. Relate these readings to the particular fan curve in terms of CFM handled.

Electrical Current/Voltage:

Measurements to be taken at the drive motor on each piece of equipment.

Fan Speeds:

To be measured in RPM.

Instrumentation List:

A list of instruments by type and make used in gathering the CAB data.

Drawings:

The CAB contractor's working drawings shall have the supply air openings numbered and/or lettered to correspond to the numbers and letters used on the report data sheets so that data in the report can be correlated with each specific supply air opening in the building. If room numbers actually used in the building differ from those on the plans, the building room numbers shall be marked on these plans. Only one such marked-up set of drawings need be provided with the two copies of the CAB report.

Before final acceptance of the CAB report, the report data, at the discretion of the Owner, shall be verified one time on the job site, by selection of check points (not to exceed 10 percent of total) at random, in the presence of the Owner's Representatives. Representatives of the testing firm doing the work shall be present and provide the necessary equipment for test data verification. The Owner shall provide written data notice of acceptance of the report and, after clarification of any question by Owner, shall be considered final.

The firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, all dampers in the duct system, all air distribution devices, the flows of freon thru all coils, and the power consumption of all motors. The contractor, mechanical contractor, the various subcontractors involved, and the suppliers of the equipment installed shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the systemic components and shall furnish all labor and material required to eliminate any deficiency or malperformance.

During the CAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. The Owner's representative will be advised of any instruments out of calibration so that the controls subcontractor may come in and recalibrate, using data supplied by the balancing firm. After recalibration, the correctness of the final setting shall be proved by taking four temperature readings at two hourly intervals in a typical room on each zone affected by the recalibration. The total variation shall not exceed two degrees from the present median temperature during the entire temperature survey period. The detailed test data recorded hereunder shall be included in the CAB report.

Make a total of three inspections within ninety (90) days after occupancy of the building to insure that satisfactory conditions are being maintained throughout and to satisfy any unusual conditions. An additional inspection in the building shall be made by the firm during the season opposite that in which the initial adjustments were made. At that time, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space. At the time of opposite season checkout, the Owner's Representative shall be given timely notification before any readings or adjustments are made so that he may participate in the checkout.

SECTION 15050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

DESCRIPTION:

This section specifies the basic materials and methods to be used in Division 15.

All materials shall be new and undamaged. Protect all materials to keep free from foreign materials.

CUTTING AND PATCHING:

Any cutting, patching, or filling necessary for the proper execution of this work, except as noted on drawings, shall be done by this contractor. Where any other part of the building is involved, it shall be done by a competent workman in a neat and workmanlike manner. No rough or unsightly work will be allowed. Cutting of structural members shall be done only with the approval of the Owner's Representative.

The attention of the contractor is directed to the requirements of running pipes and ducts thru concrete slabs, walls, and beams. These conditions are to be anticipated and sleeves installed, as provided for under "Sleeves." Sleeves shall be placed in structural members only where approved by the Owner's Representative.

INSERTS:

Furnish and set, in all necessary locations, before or during construction, unistrut inserts for use in connection with the support or placing of piping, ductwork, and equipment furnished under this division of the work.

SLEEVES AND BOXES:

Sleeves for Concrete or Masonry Surfaces:

For pipes passing thru masonry or concrete construction, provide sleeves at least two pipe sizes larger than the pipe passing thru and made from sections of steel pipe. Provide galvanized iron sleeves with collar on each side of wall for all ducts passing thru similar construction.

Sleeves Thru Floors:

All sleeves thru floors above grade shall be watertight with waterproof caulking around pipes and ducts.

PIPE LOCATION AND ARRANGEMENT:

All piping shall be racked and supported to run straight and true.

Piping shall be racked and run to facilitate maintenance work.

Under no circumstances shall valves, shock absorbers, drip traps, or piping specialties be installed in a "closed space" without proper access provided for future service and maintenance.

NOTE: All piping shall be capped or plugged at the end of each work shift and when not being extended, to prevent the entry of rocks and debris.

Any time lines are broken or disconnected, they shall be capped immediately after flushing to remove rock and debris from pipes. **If rocks or other foreign materials are found in the system after it has been closed, the contractor shall stand the expense of their removal.**

Pipes shall not be bent to change direction. Approved fittings must be used.

All equipment to be installed so as to permit disassembly for maintenance purposes.

PIPE GRADING AND SLOPE:

Piping shall be uniformly graded in direction of flow as noted below:

PIPING	FALL/RISE	DIRECTION	PER/RUN
Condensate Drip	1"	Down	4'

VIBRATION ISOLATION:

All mechanical equipment over 5 H.P. shall be isolated in accordance with Table 27, Chapter 52, in the 1987 ASHRAE Guide and Data Book Systems Volume.

Piping and ductwork in the Mechanical Room and for the first three (3) support points away from remotely located mechanical equipment shall be isolated with Type 2 isolators with a minimum deflection of 1.0 inches. Isolators for upper floor equipment shall be selected from the "30' Floor Span" column. All vibration isolators and equipment bases shall be of the same manufacture.

Extreme care shall be taken by this contractor to prevent the transmission of vibration from equipment to building structure. Flexible connectors shall be installed in all piping connecting to moving equipment, such as pumps, air handling units, compressors, etc.

Flexible connection shall be specifically designed to absorb noise and vibration and to prevent damage to equipment caused by piping stress. Unit construction shall consist of heavy bellows type neoprene rubber hose sections with stainless steel liners and attachments to match piping.

PART 2 - PRODUCTS

PIPING SYSTEMS:

All piping shall be in accordance with the American Society for Testing and Materials, ASTM A-53. No foreign made piping will be accepted in this construction.

Exposed piping, fittings, valves, and trim at plumbing fixtures shall be chrome-plated.

Refrigerant piping shall be Type "L" copper tubing with "sil-fos" silver brazed wrought copper fittings. Piping shall conform to ASTM Standard B88. Include schedule 40 pvc sleeve for underground refrigerant piping.

All refrigerated air conditioning which has cooling coil condensate drip pans with pipe connections shall be piped to the nearest drain by this contractor. Provide condensate pump as scheduled. Coordinate routing of pumped condensate with plans. Pipe location and routing shall be approved by the owner's representative. Piping shall be the same size as the drain pan connection, and shall be Type "M" copper with soldered wrought fittings. Drain shall be trapped to prevent forced air flow thru the pipe.

HANGERS AND SUPPORTS:

Vertical Piping:

Attachment - Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and to carry the weight of the pipe and contents. Stacks shall be supported at their bases, and if over two (2) stories in height at each floor by approved metal floor clamps.

Copper tubing shall be supported at each story for piping one and one-half (1-1/2) inches in diameter and at not more than six (6) foot intervals for piping one and one-quarter (1-1/4) inches in diameter and smaller.

Horizontal Piping:

Supports - Horizontal piping shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

Copper tubing shall be supported at approximately 6-foot intervals for piping one and one-half inches and smaller in diameter and at 10-foot intervals for piping two inches and larger in diameter.

Where piping is run adjacent to walls or steel columns, it shall be supported from steel brackets or vertical channel hangers. Brackets shall be Grinnell Figure PS 732 or PS 3282 as directed, or approved substitute. Channel systems shall be approved for each condition on an individual basis.

Furnish all hangers, inserts, brackets, anchors, guides, sliding supports, etc., and all auxiliary steel necessary for the installation. All supports shall be designed in accordance with the AISC Steel Handbook.

Pipe covering protection saddles shall be installed at all pipe hangers which support insulated "hot surface" piping.

All suspended copper piping shall be securely supported from the building structure at intervals specified and/or as recommended by the pipe manufacturer. Hanger shields shall be functionally similar to isolators with Grinnell Fig. 97 hangers.

All piping in mechanical equipment rooms shall be supported with Fee and Mason Figure 402, 403, or 408 vibration control hangers.

Plumbers' tape, chain, or wire will not be permitted.

UNIONS:

Ground joint unions shall be installed on pipe 2-1/2" and under where indicated on drawings. Whenever piping is connected to a major piece of apparatus, unions shall be provided as near as practical on each side of the apparatus.

ISOLATION FITTINGS:

Approved isolation fittings shall be installed at the junction of all copper and steel piping to prevent electrolytic action. Fittings shall be as manufactured by Walter Vallett Co., Corrosion Services, or approved equal.

V-BELT DRIVES:

Capacity of V-belt drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.

V-belt drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.

Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bushed type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

MAGNETIC STARTERS:

Contractor furnishing packaged equipment with motors 1/2 HP and larger in size shall furnish factory-mounted magnetic starters on all motors. Magnetic starters shall provide both overload and undervoltage protection and shall have integral hand-off-auto switches, auxiliary contacts, and pilot. All motors installed under this contract shall have a disconnect switch in the immediate vicinity of the motor. Starters on three phase motors shall protect all three legs of the circuit. Starters to be Cutler-Hammer, Square "D," Westinghouse, or Furnas.

Starters for all motors on other than "packaged equipment" which are furnished under the mechanical section of the work will be furnished and installed by the electrical contractor. Starters shall be two-speed or explosion-proof type where required. Provide a heater index bound in the O & M manuals for all starters furnished on the project.

SEISMIC RESTRAINTS:

All Division 15 equipment, piping, and ductwork shall be anchored and seismically restrained as required by the IBC for Seismic Zone 3, NFPA 90A (current edition), UL Standard 181, Tri-services Manual Fagel Et Al 1973, and the SMACNA Guidelines for seismic restraints of mechanical systems.

The Division 15 contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with Seismic Zone 3 of the Uniform Building Code.

All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment.

Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal.

The above qualified seismic engineer shall determine specific requirements on equipment anchorage and restraints, locations and sizes based on shop drawings for the mechanical equipment which have been submitted, reviewed and accepted by the Owner's representative for this project.

The Division 15 contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed for the equipment shop drawings and certified correct by the equipment manufacturer for Seismic Zone 3 with direct anchorage capability.

Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.
2. The professional seal of the engineer who is responsible for the design of the Vibration and Seismic restraint System for isolated equipment.
3. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.
5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.
6. The location of all restraints of pipes and ducts with the locations shown on a floor plan noting the size and type of anchorage and restraint to be used.

Snubbers:

Snubbers shall be double acting and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.

Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch nor more than 1/4 inch.

A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.

Design and Installation:

General: All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed or supported to withstand seismic disturbances and remain operational. Provide all engineering, labor, materials and equipment for protection against seismic disturbances as specified herein.

All equipment not anchored directly to the floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

Isolated Equipment: All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.

Piping: All isolated and non-isolated piping 2-1/2" I.D. and larger shall be protected in all planes by restraints to accommodate thermal movement as well as restrain seismic motion. Where necessary the piping restraints shall be resiliently attached to the piping with vibration dampening inserts to prevent the transmission of vibration to the building structure. Locations shall be as scheduled and shall include but not be limited to:

At all drops to equipment and at flexible connections.

At all 45 deg. or greater changes in direction of pipe.

At horizontal runs of pipe, not to exceed 30 ft. O.C. spacing.

Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.

Piping in mechanical rooms shall have additional restraints as scheduled.

Non-Isolated Equipment: The restraint systems for all non-isolated equipment are to be installed to resist stresses produced by lateral forces according to Sec. 2312 of the Uniform Building Code with an Occupancy Importance Factor of 1.5, a Seismic Zone Factor of $Z = 0.75$ for Zone 3 and a Horizontal Force Factor for Elements of Structures and Nonstructural Components of $C_p = 0.3$. In addition, the vertical forces restraint requirement shall be half the value of the horizontal forces. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company

Manufacture and design of restraints and anchors for internally isolated equipment shall be the responsibility of the manufacturer of the vibration isolators furnished with the equipment.

Piping, ductwork, and equipment without moving parts shall be restrained as shown and noted on the drawings. Locations shown are approximate and shall be coordinated with other trades and with the structural engineer at the job site.

Field Services:

The seismic restraint manufacturer's engineer shall inspect the final installation and shall certify that all seismic restraints have been installed per manufacturer's instructions and applicable codes and standards. A letter of certification shall be provided in O&M manuals and on CD Rom.

PART 3 - EXECUTION

TESTING:

All piping shall be tested in accordance with Section 15042 prior to applying insulation or concealing in partitions, wall, etc.

INSTALLATION OF UNDERGROUND PIPING:

The contractor shall obtain necessary permits prior to beginning installation.

All excavation, backfill, and repair shall be provided by the mechanical contractor in strict compliance with the specification.

Verify and coordinate with Engineer, all existing utilities, including water, sewer, storm drain, telephone, gas, and power at location of underground refrigerant piping routing as shown on plans.

The contractor shall be responsible for all costs occurring due to damage to any utility.

The contractor shall exercise care when excavating adjacent to footings, foundations, and existing utility lines and appurtenances to insure that their structural integrity is not compromised. Provide temporary bracing, blocking, and support as required to complete the work.

Immediately after the system is installed in the trench, a partial backfill shall be made in the middle of each unit leaving the joints exposed for inspection of the hydrostatic test. No leakage shall be allowed.

ACCESS:

All valves and equipment shall be located to allow easy access for inspection, test and balance, and operation. If valves are installed in inaccessible locations it shall be this contractor's responsibility to furnish and install access doors of a type approved by the owner's representative.

Locate piping, valves, etc., to allow easy access to and maintenance of equipment. Do not block walkways or tube-pull space in equipment rooms.

LOCATIONS & ARRANGEMENTS:

All pressure gages and thermometers shall be so installed so to be easily removable from an eye level 5'-6" above the floor.

Test plugs on flow measuring stations shall be unobstructed, and shall be arranged in the piping per manufacturer's recommendations.

All equipment and accessories shall be installed to facilitate proper service and maintenance in compliance with the manufacturer's recommendations.

EXCAVATION AND BACKFILL:

All necessary excavations and backfilling for the mechanical phase of this project shall be provided under this section. This includes all excavating and backfilling required in the construction of underground refrigerant piping systems for which this contractor is responsible.

Trenches for all underground lines shall be excavated to the required depths. The bottom of the trenches shall be compacted hard. The compacting shall be done by wetting and tamping or other methods, depending on the soil conditions. All rocks, trash, or other debris shall be removed before piping is laid in place.

After pipe lines have been inspected and tested, the trench shall be backfilled with selected material. Backfill shall be placed in layers and compacted to density that will prevent excessive settlement. The backfill material, thickness of layer, and method of compacting shall comply with the pipe manufacturer's recommendations and shall be approved by the Owner's representative.

No trenches shall be cut near any footings without first consulting the Owner's Representative. All backfilling in this area shall be done according to his direction.

GREASING AND OILING:

Prior to placing the equipment in operation, the bearings on all motors, fans, pumps, etc., shall be properly lubricated with a lubricant suitable for the service.

Lubrication instruction tags are to be left on "all" bearings and equipment for the Owner's future use. Only lubricants recommended by the equipment manufacturers shall be used.

It shall be incumbent on the contractor to operate the building equipment used for temporary heat, etc., in a prudent manner to insure that when the building is turned over to the Owner, all equipment is in a "first class" condition.

Equipment shall not be operated unless:

1. All safety devices are installed and functioning properly.
2. Filters are in place on fan systems. Filters to be new and clean.
3. Equipment is properly greased and oiled.
4. Belts and drives are properly aligned and adjusted.
5. The owner's representative has given written approval.

The contractor shall maintain a current "equipment maintenance" chart in the construction shack of the construction manager at all times. This chart shall be posted in a conspicuous place and shall include all items of maintenance necessary for proper operation of the equipment.

REFRIGERATION PIPING INSTALLATION:

Refrigeration tubing shall be cut (with a pipe cutter) so ends are perfectly square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall always be guided with a miter box to insure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.

The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished. Fine crocus cloth or fitting brushes especially made for this type of work should be used. Surfaces shall be burnished until all dirt and oxide is removed. Cleaned surface should not be touched with hands or gloves.

A light coat of brazing flux shall be applied to both pipe and fittings. Acid flux (such as muriatic or hydrochloric acid) shall not be used. The resulting corrosion would seriously affect the pipe and composition for brazing.

Joint shall be heated to proper brazing temperature, being sure that it is uniformly hot so brazing material will flow to all parts of the joint. The brazing material shall be fed to the joint until a uniform line of brazing material appears around the pipe at the end of the fittings.

Refrigerant piping shall be joined with "sil-fos" soldered joints. "Easy-Flow" solder may be used for connections at valves and specialties only.

An oxy-acetylene torch shall be used for heating the joint for brazing. During brazing, the pipe and fittings must be kept full of an inert gas, N or CO2 to prevent formation of scale.

NOTE: Should the contractor be observed by the job superintendent or any authorized inspector soldering or brazing any part of a refrigeration piping system without proper circulation of inert gas thru the lines being worked on, it shall be assumed that the entire system was fabricated in such a manner, and all of the piping installed on that system shall be condemned and promptly removed from the job site at the expense of the contractor.

When solenoid stop valves are being installed, the coil shall be removed to prevent the heat of soldering from ruining the insulation. When sight glasses are being installed, the glass should be removed to prevent cracking. No heat shall be applied near the bulb of the expansion valve or any other place where an excessive temperature may cause damage.

All of the foregoing piping shall be examined, and if found to leak, shall be made tight and test repeated until the system is proved tight. All tests shall be verified by the Owner's representative.

After all refrigeration piping and connections are completed, make a leak test by filling the system with freon and test for leaks with an electronic leak detector. Evacuate all piping to 500 microns and hold for 24 hours prior to final charging.

Charge the system with clean, dry refrigerant until a proper operating charge has been added as determined by proper operation with a clean refrigerant stream at the sight of glass.

Pipe covering shall not be installed, nor the piping anchored until testing is completed and all leaks have been properly eliminated.

Underground piping shall be installed in a schedule 40 PVC sleeve. Sleeve shall be installed 36" below finished grade.

SWEAT CONNECTIONS:

Copper piping in domestic water service: Piping shall be cut (with a pipe cutter) so ends are square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall be guided with a miter box to insure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.

The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished. Fine crocus cloth or fitting brushes should be used until all dirt and oxide is removed.

A light coat of soldering flux shall be applied to both pipe and fittings. Acid flux shall not be used.

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Joints shall be uniformly heated to proper soldering temperature to insure that solder will flow to all parts of the joint. The solder shall be fed to the joint until a uniform line of solder appears around the pipe at the end of the fittings.

Piping shall be joined with 'Stay-Safe-50' or 'Silvabrite-100' no lead solder.

When valves are being installed, the non-metallic parts shall be removed to prevent the heat of soldering from damaging the valves. No heat shall be applied near where an excessive temperature may cause damage.

MOTORS AND STARTERS:

This contractor shall furnish all motors required and necessary to operate equipment furnished by him. The voltage, phase, and horsepower of each motor shall be coordinated with the electrical contractor prior to ordering.

SECTION 15180 - INSULATION

PART 1 - GENERAL

WORK INCLUDED:

It is the intent of this section of the specifications that all hot (above 105° F) and cold (below 55° F) surfaces of all piping and mechanical system components be insulated, unless specifically excluded herein.

Systems to be insulated:

1. Supply air ductwork
2. Refrigerant suction piping systems

The providing of all materials, supplies, equipment, tools, transportation, and facilities and performing all labor and service necessary to provide the work outlined above and as shown on the working drawings.

PART 2 - PRODUCTS

COMPLIANCE:

All insulation shall conform to the requirements of the building code and have a flame spread rating of less than 25 and smoke developed less than 50.

Insulation shall be as manufactured by Schuller, Owens-Corning, Knauf, Armstrong, or Certainteed.

REFRIGERATION SUCTION PIPING:

Refrigeration suction piping shall be insulated with 1/2" thick closed cell flexible foam. Finish with two heavy coats of gray insulation sealer.

PART 3 - EXECUTION

GENERAL:

The contractor shall provide a complete installation which is neat in appearance and functional. Remove all excess materials and packaging from job site.

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All insulation shall be continuous through wall and ceiling openings and through sleeves. Insulation on all cold surfaces where vapor barrier jackets are used will be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.

NOTE: Rigid insulation shall have characteristics suitable for temperature, moisture and load conditions of the particular pipe being supported.

Vapor barrier wrap shall be sealed tight and not penetrated by the hanger or shield. Specified adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon. Where insulation pipes pass thru sound or fire-rated walls, floors, or ceilings, the insulation sleeves shall be sound or fire-rated to match rating of surface penetrated.

INSULATION WORKMANSHIP:

All insulation shall be applied by specialists experienced in the field, and shall be neat in appearance. Neatness in appearance shall be equated to proper insulation application procedures, and sloppy workmanship will not be tolerated. Work which is deemed unacceptable shall be condemned, removed, and replaced at the contractor's expense. Protect floors, valve handle, accessories, etc., to keep paste off areas not being insulated.

CLEAN UP:

The piping shall be cleaned and tested prior to installation of insulation, and fittings shall be cleaned after insulation is installed.

SECTION 15700 HEATING-COOLING

PART 1 - GENERAL

SCOPE:

The installation covers the furnishing and installing of furnaces, DX coils, condensing units, refrigerant piping, electric radiation, and all necessary trim and specialties, etc., as specified and shown on drawings and as required to provide the complete heating and air conditioning systems shown on the drawings and specified herein.

PART 2 - PRODUCTS

AIR HANDLING UNITS:

Furnish and install air handling units as indicated on plans. Size and capacity shall be as shown in the schedule included on the drawings.

Casing shall be of sectionalized construction and completely fabricated of galvanized steel, adequately reinforced with galvanized steel angles and channels to form a rigid assembly. Large access panels shall be provided in fan section and coil sections to permit full access to internal components. The complete casing shall be internally insulated with 1" thick blanket type, vinyl-coated glass fiber insulation, secured in place by means of high adherence strength adhesive. Casings shall be furnished with baked enamel finish.

Drain pan shall be heavy gauge galvanized steel, one-piece I.A.Q. type construction with "V" shaped bottom and drain connection located in the side of the pan. Drain pan shall be internally insulated with 1" thick rigid board glass fiber, and covered with a protective layer of 1/2" thick coating of waterproofing compound. Provide drain lines, as indicated on the plans.

Fans shall be centrifugal, forward curved blade type, DIDW, with inlet vanes, statically and dynamically balanced, rated and tested in accordance with AMCA requirements. Wheels and housings shall be constructed of heavy gauge galvanized steel. Housing inlets shall be die-formed.

Fan shaft shall be solid cold-rolled high carbon steel, or of tubular steel, ground and polished, and shall be so designed that its operating speed is well below its first critical speed. Fans shall be mounted in a single shaft.

Fans, shaft and bearings shall be assembled as a unit and carefully balanced statically and dynamically for smooth operation.

Bearings shall be self-aligning, permanently lubricated ball bearings. All bearings shall be of heavy duty design, selected for an average life of 200,000 hours.

Motor shall be as specified in Section 15050. Motor shall be quiet and pre-run at factory. Motors on units with variable speed drives shall have mechanical and electrical characteristics carefully matched to the drive unit to insure maximum efficiency.

Motor mount shall be hinged type for easy adjustment of belt tension.

Drive shall be V-belt. See Specifications, Section 15050.

Coils shall be circuited for counterflow heat transfer, and shall be constructed of 5/8" O.D., 0.025" wall thickness, seamless copper tubing with helically-wound or plate-type aluminum fins not less than .012" thickness or copper fins not less than .008" thickness. Coils constructed of all copper shall be solder-coated after fabrication.

Coil casings shall be formed from galvanized sheet steel #16 U.S.S. gauge. All coils shall be tested under warm water at a pneumatic pressure of not less than 400 psig. Position of cooling coils in unit casing shall be vertical. No devices shall be used inside water coil tubes which may increase the water pressure drop and interfere with drain-ability. Coil headers shall be Schedule 40 steel pipe or copper for water coils. Provide drain connection and air vent on each cooling coil to permit drainage during winter operation of the system.

Units shall be furnished with combination filter-mixing boxes with low leakage mixing dampers.

Filters shall be 30% efficient (ASHRAE Std. 52-76).

Provide new filters at date of substantial completion plus one spare set (stored on site) for the owner's future use.

Provide magnehelic filter gage on all systems 10,000 CFM and over.

Vibration isolators shall be furnished by the contractor.

Units shall be Trane, Carrier, or McQuay.

REMOTE AIR-COOLED CONDENSING UNITS:

Furnish and install remote air-cooled condensing semi-hermetic units complete with heavy gauge zinc-coated steel casings, compressor motor assemblies, condenser coils, fans, receivers, crankcase heaters, and high and low pressure safety controls, and all operating controls. Provide automatic operation pumpdown cycle on the condensing units.

Casings: shall be heavy gauge zinc-coated steel panels.

Compressors: shall have single or multiple copeland coplematic semi-hermetic reciprocating compressor motor assembly as specified. Compressors shall be suspended and mounted on vibration isolators. The motor and compressor sealed in one casing shall be constructed against dirt, air, and moisture. Compressors shall have capacity reduction and hot gas by-pass.

Condenser coils: shall be direct expansion type with primary surface constructed to seamless copper tubes, staggered in relation to air flow. The secondary surface shall be constructed of plate-type aluminum fins, either mechanically or metallically bonded to the tubes. A coils factory test shall be made at 300 psi under water and completely dehydrated under a vacuum while heated to at least 175 f. Coils shall contain extra liquid subcooling circuits for high capacity cooling.

Unit shall be equipped with microcomputer control. The computer shall have a simple keyboard accessed input system and be complete with a two line 80 character alphanumeric display. The micro-computer shall continuously monitor either evaporator return or leaving air temperature; suction and discharge pressure of each refrigerant circuit.

The microcomputer shall be complete with all hardware and software necessary to enable remote monitoring of all data through the addition of only a simple, optional, modem. The microcomputer shall be complete with an rs232 "local" communications port and an rs485 long distance differential communications port. The microcomputer shall also accept a remote start and stop signal, and 0 to 5vdc evaporator temperature reset signal.

The contractor shall install the unit on a properly designed and constructed concrete pad or directly on a frame of sufficiently sound construction.

Provide the factory installed options:

1. Indicator lights
2. Control transformer and fuses
3. Under voltage and phase protection relay
4. Microcomputer
5. Discharge, suction and oil pressure gauges
6. Low ambient start and operation
7. Unit mounted disconnect
8. Steel painted louvers for complete unit enclosure for general mechanical security and unit aesthetics. Factory color shall be selected by school district.
9. Under voltage and phase failure protection relay against low voltage or phase reversal.
10. Over and under voltage protection relay protects against high and low incoming voltage conditions as well as single phasing, phase reversal and phase imbalance.
11. Circuit breakers to provide branch circuit protection.

12. Fully painted unit meets the requirements for outdoor unit application of 500 hour salt spray paint tested in accordance with astm-b-117.
13. Auxiliary control module providing auto circuit to circuit lead-lag where applicable, utility demand limiting (requires an external 0 to 5 volt dc signal), load limiting by compressor over current protection, high pressure limiting, low pressure limiting, and extra steps of capacity control.

Provide a full 5-year parts and labor factory compressor warranty.

Condensing units shall be Dunham-Bush, Rheem or Carrier.

PART 3 - EXECUTION

COORDINATION:

All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.

Provide valves and unions or flanges at all pieces of equipment to allow maintenance.

Install all control dampers, sensors, etc., as directed by the control contractor.

PROTECTION AGAINST THE ELEMENTS:

The contractor shall, at all times, take reasonable and adequate precautions to protect his work and all stored materials and equipment from damage by the elements, including flooding, windstorms, etc., and shall not expose the work of any other contractor to such damage.

SECTION 15800 - AIR DISTRIBUTION

PART 1 - GENERAL

SCOPE:

Work shall include supply, exhaust, and ventilation duct systems and all materials, equipment, and labor required to complete the systems shown on plans and specified herein.

PART 2 - PRODUCTS

Construct all ducts, plenums, etc., of the gauges specified in the latest editions of the applicable SMACNA Manuals, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots. Construct ducts using double or Pittsburgh corner seams. All seams shall be hammered and made airtight.

Joints shall be fabricated 100% airtight at 2" H₂O S.P., using a joint system similar to "Duct Mate" or Lockformer with gasketed joints.

Duct construction details shall comply with the latest edition of the SMACNA "Low Velocity" sheet metal and duct manuals.

Cross Breaking:

Sheet metal ducts shall be cross broken on the four sides of each 4' panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4' panels of straight sections of ducts shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.

LOW PRESSURE RIGID ROUND DUCTS:

Double wall K27 insulated round ductwork is to be used on section of supply ductwork from outlet of air handler to a point as indicated on plans.

DUCTWORK:

Curved elbows shall have centerline radius equal to 1-1/2 times the width of duct. Vanes shall be single thickness installed where shown. Air turns shall be installed in abrupt elbows and shall consist of curved metal blades or vanes with extended trailing edges arranged so as to permit air to make abrupt turn without appreciable turbulence. Air turns shall be quiet and free from vibration when system is in operation.

Sheet metal ducts shall be properly braced and reinforced with galvanized steel angles or other structural members, and where they protrude above roof, they shall be properly flashed. Internal ends of all slip joints shall be installed in direction of flow. Snap lock seams will be permitted on duct gages 22 ga. and lighter.

Dimensions:

Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes are free area inside dimensions. Acoustically lined ducts shall have outside dimensions increased, as required, to accommodate the acoustic lining specified and still maintain the face area inside dimensions shown on the drawings.

Field Verifications:

No ductwork shall be fabricated without first field verifying that the available space under actual job conditions will permit installation of the ductwork without structural or other conflicts.

Access Doors:

As indicated on the drawings, for proper access to fan plenum spaces, dampers, filter access spaces, etc., provide and install sheet metal access doors of the size as noted or as required for proper access to the equipment. Those doors shall be constructed of No. 22 gauge metal and as follows:

Door Construction:

Doors shall be provided with a flat iron or angle iron stiffening frame and so constructed that they can be operated without twisting or distortion. Doors on insulated ductwork shall be of double panel construction provided with an approved type insulated filler, not less than 1" thick. The duct opening at each door shall be provided with a continuous reinforcing galvanized bar or angle against which the door will close, this being provided with a sponge rubber gasket to make the door airtight.

Fasteners:

Doors shall be constructed of galvanized iron and shall be airtight. The contractor shall furnish a sample access door for approval before fabrication.

Flexible Connection:

Provide flexible connections, not less than 4" wide, constructed of heavy weatherproof woven "Durolon" glass fabric, at the inlet and outlet connection of each, securely fastened to the unit and to the ductwork by a galvanized iron band, provided with tightening screws.

Test Holes and Duct Ports:

Furnish test holes and duct ports at locations shown on the drawings, and as required for testing of air quantities in ducts. Where these holes are installed in ductwork which is insulated, there shall be provided an extension collar to match thickness of insulation material.

Test holes shall have Young Regulator Model 110 instrument ports. Duct ports shall be Airsan Model SH.

RECTANGULAR DUCT LINING:

The interior surface of all low pressure supply, return, fresh, relief, and exhaust air ducts (except where noted otherwise), shall be lined with 1" thick fiberglass dual density duct liner, having an average "K" factor of .23 BTU at 75 deg. F mean. The liner shall meet standards NFPA No. 90A and No. 90B, shall have an interior liner resistant to microbial growth per ASTM G-21 and ASTM G-22, and shall have the Underwriters' Laboratories, Inc., label.

Duct liner shall be applied to the flat sheet with a 100% coverage of duct adhesive. The duct liner shall be cut to assure snug corner joints. The black surface of the liner shall face the air stream. On horizontal runs, tops of ducts over 12" in width and sides over 16" in height shall be additionally secured with welded pins and speed clips on a maximum of 15" centers. On vertical runs, gripnails or welded pins and speed clips shall be spaced on a maximum of 15" centers on all width dimensions over 12". Pins shall start within 2" of all cross joints within the duct sections. Welded pins shall be cut virtually flush with the liner surface. Clips should be drawn down flush only and not so as to compress the liner and cause the leading edge of raise. All exposed edges and the leading edge of all cross joints of the liner shall be coated with adhesive.

GRILLES:

Furnish and install complete the registers and grilles of the size and type shown on the drawings. All supply grilles to be complete with opposed blade balancing dampers. Large return air grilles shall be reinforced at time of installation to provide a sturdy, vibration-free installation. All grilles

shall be steel construction, unless specified differently on plans or in equipment schedule. All grilles shall have "off-white" finish, unless otherwise specified.

Grilles shall be Titus, PRICE or Tuttle & Bailey.

Coordinate all grilles with architect.

General: All surfaces behind grilles (return) shall be painted flat black.

LOUVERS:

At all air system openings in outside wall, install storm louvers.

Construct louvers of aluminum with kynar custom color finish. Color shall be selected by Architect.

Slats shall be inclined at least 45 degrees from the horizontal and overlap a minimum of 1". Slats over 40" long shall have a 2" wide intermediate support. The exterior face of the louver shall be neatly fitted to the building wall, flashed at top, and caulked at sides and bottom. New open area for air passage shall be at least 50% of the nominal size. On the inside face of the louver, install a removable screen, consisting of 1/2" mesh galvanized wire screen in a galvanized channel frame. The louver shall have a sub-frame and shall be removable.

Caulk around louver frames with clear G.E. silicone sealer after installation.

Louvers shall be Airolite, Air Balance, Air Guide, American Warming or Dowco.

LOUVERED PENTHOUSES:

Furnish and install complete the louvered roof penthouses shown on plans and specified in the Equipment Schedule. All units shall be rigid aluminum construction, with 4" type 'L' stormproof louvers, complete with birdscreen, reinforced self-flashing insulated base, color anodized finish, and all accessories required for a complete installation. Penthouses shall be designed and fabricated to withstand wind gusts of 150 MPH without physical damage.

Roof hoods shall be Titus, Penn, or Western Vents and Curbs.

DAMPERS - GENERAL:

Damper frames shall be of not less than 13 gauge galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.

All damper blades shall be of not less than 16 gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must be of not over 6" in width. Blades shall be secured to 1/2" diameter zinc-plated axles by zinc-plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon-coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blades linkage hardware shall be construction of corrosion-resistant, zinc-plated steel and brass.

RELIEF AIR DAMPERS:

The ATC contractor shall furnish all automatic control dampers with pressure differential sensor. The sheet metal contractor shall install all dampers and transition all ductwork to the dampers. Frames shall be of 13 gauge and blades double 22 gauge galvanized sheet steel. Dampers shall have leakage of 1/2% (based on 2000 FPM approach velocity and 4" W.B. pressure). Dampers shall be selected to precisely control the flow of air in the fresh, return, relief, and exhaust systems.

All modulating dampers to be of opposed blade type. Maximum blade width not to exceed 6 inches.

Dampers shall be similar to Ruskin model CD-50.

Dampers of other manufacture may be approved provided construction, leakage characteristics, etc., are equal to the specified dampers specified above.

PART 3 - EXECUTION

SURFACE CONDITIONS:

Inspection:

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that the work of this section may be installed in accordance with all pertinent codes and regulations in the approved shop drawings.

Discrepancies:

In the event of discrepancies, immediately notify the Owner.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

Should the contractor proceed with the work without so resolving the discrepancy, he does so on his own responsibility.

INSTALLATION OF EQUIPMENT:

General:

Install all equipment where indicated on the drawings, allowing adequate space for service to all equipment items.

Avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner.

INSTALLATION OF DUCTS:

General:

Install all equipment where indicated on the drawings, allowing adequate space for service to all equipment items.

Avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner.

All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided, as may be required. Whenever this is necessary, the required area shall be maintained. All changes, however, must be approved and installed as directed.

During the installation, the open ends of all ducts shall be protected by covering with plastic sheet tied in place to prevent debris and dirt from entering.

Install this work in cooperation with other trades so that there will be no delay in progress of construction work. It is extremely important that the duct system be clean before final connections are made.

Hanger and Supports:

Hangers for ducts up to 18" in width shall be placed on not more than 8'-0" centers. Ducts 19" and over in width shall be supported on not more than 4'-0" centers. Hangers shall be placed plumb and present a neat appearance. Construct hangers from galvanized band iron 1" x 1/8" for

duct up to 36" wide. Hangers shall extend down the sides of the ducts not less than 9". On ducts less than 9" in depth, hangers shall extend the full depth of the ducts. Attach hangers to ducts using not less than three rivets or Parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs, supporting angles shall be galvanized and of sufficient size to support the ductwork rigidly. Place supporting angles on at least two sides of the duct. For round ducts, strap hangers shall extend completely around ducts.

Ducts at Masonry:

Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 3/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying fire-rated insulation and caulking compound.

Sheet metal at these locations shall be bolted to the angle irons.

The annular space around the ducts shall be packed with fire safing insulation and caulked or sealed, as required, to maintain the fire-rated integrity of the wall.

CLEANING OF DUCTS:

Before the ceiling is installed and final connections are made to the outlets, it will be required that all fans be operated at full capacity to blow out dirt and debris from ducts.

SECTION 15900 - AUTOMATIC TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

GENERAL CONDITIONS:

The requirements of Section 15010, 15030, 15042, 15043, 15050, 15700, 15800, the Notice to Bidders, General Instructions, and General Conditions, as hereinbefore written, shall form a part of these specifications, and the contractor shall consult them in detail for instructions pertaining to the work.

SCOPE OF WORK:

The work, under this section, shall include all materials and labor for a complete electric/electronic temperature control system in conformity with the plans, the specifications, and other contract documents. The system shall be furnished and installed by Barber-Colman, Engineered Control Systems, or Johnson Controls.

SUBMITTALS:

After award of contract, submit for approval six (6) copies of control diagrams. Submittal shall include complete diagrams and schematics showing control equipment, terminal identifications, material list, and sequence of control.

Submittal Format: Control submittals must follow the specification format in an orderly and sequential manner. Complete submittal data shall be included on all items of equipment under the proper headings, with features called for in the specifications "clearly identified." All control panels shall be drawn up to scale with switches, gauges, pilots, alarms, etc., clearly shown and identified.

Control schematics shall be provided for each control sequence specified with all components clearly identified. Below each schematic shall be a copy of the written control sequence which incorporates (by number or description) each control component shown on the schematic.

Submittals not made up in the above manner will be returned unchecked.

OWNER INSTRUCTION:

Upon completion of the project, the temperature control contractor's representative shall spend the necessary time with building's operating personnel to instruct them on the operation of this system. This service shall be performed without cost to the Owner.

GUARANTEE:

The automatic control system shall be placed under a one-year guarantee after date of final acceptance by the Architect. Any calibration, parts, or labor necessary due to faulty installation or faulty equipment shall be replaced during this period at no cost to the Owner.

THERMOSTATS:

All thermostats shall be installed by the ATC contractor.

ELECTRICAL WIRING:

All electrical wiring related to the temperature control system, including motor control, shall be by the temperature control contractor with the exception of power wiring to motors, magnetic starters, and disconnect switches. All control wiring and conduit shall be installed by mechanics employed by the control manufacturer. All costs of wiring, conduit, and associated labor shall be included in the temperature control bid.

All lines and low voltage electrical wiring shall be installed in accordance with the National Electrical Code and local codes. Circuits operating at 50 volts or less shall be run in conduit or multi-conductor cable with each wire covered by 0.031 inch 105 deg. C. Insulation and covered with plastic sheath for 105 deg. C 600 volt service, if concealed.

DAMPERS:

Furnish automatic dampers where shown on the plans. All dampers shall be completely factory assembled and shall be of the anti-leakage opposed blade type with maximum blade width of eight inches. A vinyl foam type gasket shall seal between blade edges and frame. Vinyl gasket shall seal between blades. Outside air and relief air dampers shall be both air and light tight after installation when in the closed position. Ruskin CD-50.

SEQUENCE OF CONTROL:

CONDENSING UNITS:

A cooling thermostat with "deadband" control shall cycle the condensing unit in sequence to maintain space temperature.

In the cooling mode, the thermostat shall cycle the compressors in the condensing unit to maintain space temperature.

RELIEF AIR DAMPER CONTROL:

The motorized relief air damper located below roof hoods shall have its own pressure transmitter with static pressure tips located in the area it serves on either side of the damper. During the OCCUPIED mode, the relief air damper shall modulate to maintain a positive building pressure of 0.03" WC. During the UNOCCUPIED mode, all relief air dampers shall be closed.

AIR HANDLING UNIT:

The air handling unit system consists of a supply fan, a DX cooling coil, filters & outdoor air and return air dampers.

The supply fan shall be controlled through a "OFF-AUTO" switch, located on the face of the ATC panel.

In "OFF" position, fan shall be stopped, and in "AUTO" position, fan shall be on during OCCUPIED mode and cycled to maintain minimum space temperature when in the UNOCCUPIED mode.

Fan operation in AUTO mode shall be subject to freezestat and building fire alarm.

OCCUPIED mode: A space temperature sensor shall modulate outdoor air, return air and relief air dampers, and condensing unit to maintain supply air temperature according to the following (ADJUSTABLE) schedule:

A building static pressure control system, shall modulate relief air damper in roof penthouses to maintain a slightly positive building pressure of 0.03" (adjustable) w.c.

Whenever outdoor air temperature exceeds 76° F, the outside air and relief air dampers shall close to the minimum position as determined by the return duct CO2 level transmitter and minimum ventilation requirements.

A CO2 level transmitter located in the return air duct shall reset the outside air damper minimum position. The amount of reset action shall be adjustable and subject to a maximum of 25% minimum outdoor air.

An averaging style mixed air temperature sensor shall provide 48°F mixed air temperature low limit control of the air handling system.

If mixed air temperature drops below 39°F as sensed by an electrically interlocked averaging style freeze stat, supply fan shall stop, outdoor and relief air dampers shall close.

A -0.25 to 0.25 "w.c. static pressure transmitter with an outside probe, must be a Dwyer A306, and an interior probe strategically located in an interior shall modulate the relief dampers at the roof penthouses to maintain 0.02 "w.c. building static pressure.

Outdoor air damper shall remain closed when return air temperature is below 68° F.

UNOCCUPIED mode:

Outdoor air dampers shall remain closed. Air handling unit and condensing unit shall remain off.

All units shall be supplied with a labeled occupancy override button. This button shall have a user adjustable override time to force the unit into occupied mode. The override buttons shall be equipped with an illuminated indication indicating that the override period is in progress.

FIRE ALARM FAN SHUTDOWN:

Interlock Air Handling Unit system fan to automatically shut off when the fire alarm system is energized. All fans to automatically start up again when fire alarm system is shut off.

Provide smoke detectors approved for duct installation in strict compliance with the current National Fire Protection Pamphlets No. 90A.

Detectors shall be mounted in both the return air and supply air for each fan system which circulates over 2,000 CFM.

The system shall be so arranged to stop the fan upon activation.

The duct detectors shall be manufactured by Pyrotronics and/or approved equal.

SECTION 15010 GENERAL PROVISIONS

PART 1 - GENERAL

GENERAL CONDITIONS:

The contractor shall carefully read the General Conditions of the Contract and all information to bidders which, with the following specifications for heating, cooling, plumbing, exhaust, ventilation, and temperature control are a part of the Contract.

BASIC BID:

Shall include all labor and materials specified in this division. The term "furnish" and/or "install" or similar implication shall mean "furnish and install complete."

SCOPE OF WORK:

The work to be done under this section includes the furnishing of all labor, materials, equipment, controls and accessories required to complete all heating, air conditioning, ventilating, plumbing, drainage, fire protection, and other mechanical systems as shown on plans and/or described in these specifications, or as required to provide a complete and functional facility.

Work shall include, but shall not be necessarily limited to, the following:

1. System commissioning
2. Testing
3. Balancing
4. Insulation systems
5. Air distribution system
6. Control systems
7. Air conditioning system

This contractor shall provide all miscellaneous electrical work and control wiring for special systems where the wiring requirements are provided by the equipment manufacturers and/or suppliers.

CODES AND ORDINANCES:

The work shall be installed in accordance with the state and local plumbing codes, and any other government code or ordinance that governs the type of work covered by these specifications.

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HVAC Upgrade
Utah State Fairpark**

Should any drawings conflict with the city, county, or state code, the code shall govern the proper installation of the work, and no extra charge shall be made for such change.

Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, he shall bear all costs arising in correcting the deficiencies.

Where the work required by the drawings and specifications exceeds local requirements, it shall be done as shown or specified.

DRAWINGS AND SPECIFICATIONS:

These specifications are intended to cover all labor, material, and standards of mechanical workmanship to be employed in the work shown on the drawings and called for in these specifications or reasonably implied by terms of same. The drawings and specifications are intended to supplement one another, and any part of the work that may be mentioned in the one and not represented in the other shall be done the same as if it had been mentioned or represented in both. Large scale drawings shall take precedence over layouts and small scale details.

INTERPRETATION OF DRAWINGS AND DOCUMENTS:

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the drawings or specifications, he may submit to the Owner's representative a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the proposed documents will be made only by addenda duly issued, and a copy of such addenda will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of the proposed documents.

The Owner's representative will interpret the meaning of any part of the drawings and specifications about which any misunderstanding may arise, and his decisions will be final. Should there appear to be any error or discrepancy in or between the drawings and specifications, the contractor shall refer the matter to the Owner's representative for adjustment before proceeding with the work. Should the contractor proceed with the work without so referring the matter, he does so on his own responsibility.

WORKMANSHIP:

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.

SUBSTITUTIONS:

See Special Conditions pertaining to Substitutions.

FEES AND PERMITS:

This contractor shall obtain all necessary permits and pay all fees required in connection with the work.

Rules of local utility companies shall apply at time of bidding. Contractor shall have checked with each utility company supplying services to this installation, and shall determine from them all valves, boxes, meter boxes, and meters which they will require to be installed, and shall figure cost of same in his bid. No extra payment will be made for installation of such items.

SITE INSPECTION AND EXAMINATION OF DRAWINGS:

The contractor shall carefully study all drawings and specifications pertaining to the work. If any of the work as laid out, indicated, or specified is contrary to or conflicts with any governing ordinances or regulations, the same shall be reported to the Owner's representative before submitting a bid. The Owner's representative will then issue instructions as to procedure.

The contractor shall carefully examine the building site and compare the drawings with existing conditions. By the act of submitting a bid, the contractor shall be deemed to have made examination, have accepted such conditions, and to have made allowance therefore in preparing his bid.

VERIFICATION OF DIMENSIONS:

Before proceeding with any work, the contractor shall carefully check and verify all dimensions, sizes, etc., and shall assume full responsibility for the fitting-in of his ductwork, piping, and equipment. Where apparatus and equipment has been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The contractor shall carefully check the drawings to see that the equipment he is required to install will fit into the spaces provided, and will allow for proper maintenance and service of the equipment.

Where the need for coordination drawings are deemed appropriate by the owner's representative, the contractor shall take necessary field measurements and prepare the drawings as directed at no additional cost to the owner.

RECORD DRAWINGS:

The contractor shall provide and keep up to date a complete record set of ozalid prints which shall be corrected daily to show change from the original drawings and specifications, the size and kind

of equipment, location and inverts of all buried or concealed pipes and ducts, etc. Prints for this purpose will be furnished by the Owner's Representative. This set of drawings shall be kept on the work site and shall be used only as record set. Upon completion of the work, the set of record drawings shall be turned over to the Owner's Representative.

COOPERATION WITH OTHERS:

The contractor shall so organize the work that progress will harmonize with the work of all trades, so that all work may proceed as expeditiously as possible. The contractor shall be held responsible for any delays which result from his negligence or failure to coordinate or cooperate with other contractors or crafts.

LOCATION OF PIPING AND EQUIPMENT:

The locations of all piping, ducts, apparatus, and equipment indicated on the drawings are approximate only, and shall be changed, as necessary and as approved by the Owner's Representative, to meet the actual structural and architectural conditions at the job site. Any change in work which has not been installed shall be made by the contractor without additional compensation, except changes which are caused by architectural and structural changes which increase the size of mains, the number of fixtures or the length of runs. All changes shall be made only upon approval of a written change order.

GUARANTEE:

By the acceptance of the contract award for the work herein described, the contractor assumes the full responsibility imposed by the guarantee as set forth herein and should protect himself through proper guarantee from equipment and specialty manufacturers and subcontractors as their interests may appear.

All materials and equipment provided and installed under this division of the specifications shall be guaranteed for a period of one (1) year from the date of substantial completion and acceptance by the Owner, unless specifically noted elsewhere on the plans or in the specification. Should any trouble develop during this period due to defective materials or workmanship, the contractor shall correct the trouble without cost to the Owner, any defect noticed at the time of installation and/or during the guarantee period shall be immediately corrected to the entire satisfaction of the Owner and the Owner's Representative.

SHOP DRAWINGS & SAMPLES:

After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, the contractor shall submit to the owner's representative for review in accordance with the accepted schedule of Shop Drawing submissions, or for other appropriate action if so indicated in the Supplementary Conditions, five

copies (unless otherwise specified in the General Conditions) of all Shop Drawings, which will bear a stamp or specific written indication the contractor has satisfied the contractor's responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as owner's representative may require. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable Owner's representative to review the information as required.

The contractor shall also submit to the Owner's representative for review with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that the contractor has satisfied the contractor's responsibilities under the Contract Documents with respect to the review of the submission and will be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which intended.

Before submission of each Shop Drawing or sample the contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each shop drawing or sample with other Shop Drawings and samples and with the requirements of the work and the Contract Documents.

At the time of each submission, the contractor shall give the Owner's representative specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and, in addition, shall cause a specific notation to be made on each Shop Drawing submitted to the Owner's representative for review and approval of each such variation.

The Owner's representative shall review with reasonable promptness Shop Drawings and samples, but the Owner's representative's review will be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. The contractor shall make corrections required by the Owner's representative, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. The contractor shall direct specific attention in writing to revisions other than the corrections called for by the Owner's representative on previous submittals.

The Owner's representative's review of Shop Drawings or samples shall not relieve the contractor from responsibility for any variation from the requirements of the Contract Documents unless the contractor has in writing called the Owner's representative's attention to each such variation at the

time of submission and the Owner's representative has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by the Owner's representative relieve the contractor from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of these specifications.

Where a Shop Drawing or sample is required by the Specifications, any related work performed prior to the Owner's representative's review and approval of the pertinent submission will be the sole expense and responsibility of the contractor.

Shop drawings shall be neatly bound in hard-backed looseleaf binders, completely indexed.

1. DX coils
2. Air cooled condensing units
3. Louvered Penthouses
4. Valves
5. Piping systems
6. Pipe and duct supports & restraints
7. Plumbing fixtures
8. Dampers
9. Grilles & registers
10. Diffusers
11. Insulation systems
12. Vibration isolators
13. Automatic temperature controls
14. Air balance contractor qualifications
15. Other schedule items as required.

Owner's Refusal Right:

In the event that items submitted are substitutions for specified items and are found to be not acceptable, the right shall be reserved to require the specified items.

OPERATING INSTRUCTIONS AND CATALOG INFORMATION:

This contractor shall compile in looseleaf binders catalogs of every product used by him in the completion of the work. The binders shall also include copies of the test data (Section 15042), balancing reports (Section 15043), and system commissioning data (Section 15030). Before final acceptance by the Owner's Representative, he shall turn over to the Owner this compilation of catalog data. A double index shall be provided, one giving an alphabetical list of products for which catalogs are included, and one giving their addresses, whose products are included in the work. Four (4) copies shall be delivered to the Owner's representative for his approval.

**HFS Architects
DFCM #07211370
HFS #0740.01**

**Promontory Hall
HVAC Upgrade
Utah State Fairpark**

Binders shall be white vinyl with see-thru front and end of panels identified as follows:

PROMONTORY HALL HVAC UPGRADE
UTAH STATE FAIRPARK
2008
OPERATING & MAINTENANCE MANUAL
SET #

PART 2 - PRODUCTS

MATERIALS, EQUIPMENT AND ACCESSORIES:

Unless otherwise specified, all equipment, accessories, and materials shall be new and undamaged, and the workmanship shall be of the best quality for the use intended, and shall be acceptable to the Owner's Representative.

Equipment, accessories, and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer. Should mechanical equipment other than that used in the design be furnished, it shall be the responsibility of the mechanical subcontractor to provide large scale installation drawings, as required, showing service and maintenance points. The layouts shall provide proper clearance for service.

All equipment shall be selected to deliver full rated capacity at the job site elevation.

PART 3 - EXECUTION

FUNCTIONING AND OPERATION OF EQUIPMENT:

Contractor's Responsibility:

Installation and startup shall be so made 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 explain to the Owner the operation of the mechanical systems and fully instruct him regarding its proper operation, servicing, and maintenance.

CLEANING AND PATCHING BY MECHANICAL CONTRACTOR:

The contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere caused by his workmen, 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.

PROTECTION AGAINST THE ELEMENTS:

The contractor shall, at all times, take adequate precautions to protect his work and all stored materials and equipment from damage by the elements, and shall not expose the work of any other contractor to such damage.

REMOVAL OF DEBRIS, ETC.:

Upon completion of this division of the work, remove all surplus material and debris resulting from his work, and leave the premises in a clean and orderly condition.

OPENINGS FOR MECHANICAL SYSTEMS:

All openings required for installation of mechanical systems shall be provided by the mechanical contractor.

SAFETY REGULATION:

The contractor shall comply with all local 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.

OWNER FURNISHED EQUIPMENT:

This contractor shall include in his bid the necessary labor and material to install the required services to equipment furnished by the Owner. This contractor shall relocate (where noted), rough-in and make final connections to owner furnished equipment.

ASBESTOS & HAZARDOUS WASTES:

Unless specifically included elsewhere in these contract documents, the removal of asbestos fiber bearing material or materials containing hazardous wastes are not a part of this contract. Should such material be identified on the contract site, the owner's representative shall be so notified.

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SECTION 16000 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section and all other Division 16 specification sections.
- B. This section applies to all Division 16 specification sections.

1.2 SUMMARY

- A. This section includes general administrative and procedural requirements for electrical installations to expand the requirements of the General Conditions and Division 1 Specification Sections.

1.3 STANDARDS

- A. The following industry standards are considered minimum requirements for electrical work and are made a part of the contract documents:
 - 1. National Electrical Code, 2005 Edition (NEC)
 - 2. Electrical Ordinances of Local Governing Authority
 - 3. Utah State Fire Marshal's Rules and Regulations
 - 4. International Building Code
 - 5. International Fire Code
 - 6. Underwriters Laboratories (UL) Standards
 - 7. American National Standards Institute (ANSI)
 - 8. National Electrical Manufacturer's Association (NEMA)
 - 9. National Fire Protection Association (NFPA) Standards
 - 10. Regulations of American Standards Association
- B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Architect promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Architect.

1.4 WORKMANSHIP

- A. All Electrical Work of any nature shall be performed by qualified electricians, experienced in the type of work to be performed and licensed with the State of Utah. Electricians shall show their license upon request of the Owner, Architect and/or their representatives.

1.5 INSPECTIONS

- A. Code inspections will be conducted by an inspection agency hired by the Owner.
- B. Contractor is responsible to schedule inspections with the inspection agency.

1.6 ELECTRICAL WORK INCLUDED

- A. The basic contract work includes all labor, material, tools, transportation, equipment, and superintendence specified, indicated on the drawings or necessary to make a complete installation of, but not limited to, the following:
1. Appliances, apparatus and materials not specifically noted on drawings or mentioned herein, but which are necessary to make a complete working installation of all electrical systems required for the project.
 2. Hangers, anchors, sleeves, chases, supports and fittings as may be required and as indicated.
 3. Complete primary electrical service with transformer, medium voltage cables, cable terminations, and connections to Owner's existing primary distribution system.
 4. Complete secondary electric service with service conduits, service conductors, main distribution panel, distribution system, and connection to existing branch circuits.
 5. All luminaires, wall switches, receptacles, etc., as indicated on drawings complete with raceway system, wiring, and outlet boxes.
 6. Electrical service to heating, ventilating and air conditioning equipment.
 7. Safety switches and other wiring necessary to connect electric power to the controls of heating, ventilating and air conditioning equipment.
 8. Fire Alarm System additions and modification, complete with all equipment in operative condition.

1.7 SUBSTITUTIONS

- A. Material or products specified by name of manufacturer, brand or trade name or catalogue reference will be the basis of the bid and furnished under the contract unless changed in writing by the Architect. Where two or more materials are named, the choice of these will be optional with the Contractor.
- B. Submit requests for substitution in writing no later than the "Last Day to Submit Questions" indicated in the Project Schedule.

1.8 ACCURACY OF DATA

- A. Data given herein and on the drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Specifications and drawings are for the assistance and guidance of the Contractor.
- B. Electrical drawings are diagrammatic, but will be followed as closely as building construction and work of other contractors will permit. All deviations from the drawings required to make the Electrical Work conform to the building as constructed and to the work of other contractors will be made by the Contractor as approved by the Architect.

1.9 VISIT THE SITE

- A. Contractors are assumed to have visited the site and thoroughly acquainted themselves with conditions affecting the proposed work. Verify existing conditions and measurements at the building before beginning work and immediately notify the Architect of any discrepancies which may adversely affect completion of the work.

1.10 TEMPORARY POWER

- A. Provide temporary power for reasonable convenience during construction in accordance with the General Conditions.
- B. Provide GFCI Protection for all temporary power outlets.
- C. Use temporary power for construction purposes only. Do not use temporary power for electric space heating, etc..

1.11 SHOP DRAWING SUBMITTALS

- A. As soon as possible after contract award, submit shop drawings for review in accordance with the General Conditions and Division 1 Specifications.
- B. Submit shop drawings in three ring loose-leaf binder.
- C. Divide Electrical equipment into subsections of common equipment. Provide a complete equipment list at the beginning of each subsection.
- D. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for the following items:
 - 1. Distribution Transformer
 - 2. Medium Voltage Cables and Terminations.
 - 3. Safety Switches
 - 4. Panelboards, Switchboards, and Circuit Breakers
 - 5. Motor Starters
 - 6. Variable Frequency Drives
 - 7. Light Fixtures
 - 8. Fire Alarm System
- E. Above list is considered minimum. Additional items may be required to be submitted for review.
- F. Refer to individual Specification Sections for additional Shop Drawing Submittal requirements.

1.12 RECORD DRAWINGS

- A. Provide As-Built Record Drawings in accordance with the General Conditions and Division 1 Specifications.
- B. Indicate location and routing of all underground raceways on the As-Built Record Drawings by dimension to permanent structures such as buildings, sidewalks, curbs, etc.

- C. Indicate all changes made to the drawings such as changes in fixture and outlet location, changes in circuit routing and circuit numbering, etc. Include all changes by Addenda, Change Order, Supplemental Instruction or verbal instruction.
- D. Refer to individual Specification Sections for additional Record Drawing requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications.
- B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.
- C. All copies of literature will be new, clean and clearly legible. Sheets used for shop drawing submittals with review stamp, remarks, etc., will not be acceptable.
- D. Divide Electrical equipment into subsections of common equipment. Provide a complete equipment list and recommended maintenance schedule at the beginning of each subsection.
- E. Refer to individual Specification Sections for additional Operation and Maintenance Manual requirements.
- F. Include copies of all factory test reports, field test reports, and inspection reports.

1.14 WARRANTY

- A. Provide Warranty for Electrical Work in accordance with the General Conditions and Division 1 Specifications.
- B. Provide manufacturer's warranty for all equipment which the manufacturer normally provides a warranty in excess of twelve months. Refer to individual Specification Sections for extended warranty requirements.

1.15 EXTRA MATERIAL STOCK

- A. Provide extra stock in original cartons, or packaged with protective coverings, for storage and identified with labels clearly describing contents.
- B. Turn over extra stock to Owner and place in storage prior to Substantial Completion. Exact location of storage to be determined by the Owner.
- C. Obtain signed receipt for extra stock materials from the Owner's Project Manager. Include copy of signed receipt in the Project Operation and Maintenance Manuals.
 - 1. Receipt shall include description and quantity of all material.

D. Provide the following extra stock of materials to the Owner.

1. Lamps: refer to Specification Section 16500 - Lighting for required quantities.
2. Transformer Fuses: Refer to Specification Section 16320 - Pad Mount Distribution Transformers for quantities.
3. Fuses: Refer to Specification Section 16475 - Fuses for required quantities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials and equipment for which U.L. Standards have been established, will be listed by and bear the label of Underwriters Laboratories, Inc..
- B. All materials will be new and bear the manufacturer's name, trade name and catalog or model numbers. Similar items will be of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of materials will comply with all codes and be accomplished with good workmanship in the judgement of the Architect and Consulting Engineer.

3.2 COOPERATION WITH OTHER CONTRACTORS

- A. Cooperate with other contractors doing work on the building as may be necessary for the proper execution of the work of various trades employed in construction of the building.
- B. Refer to architectural, structural, and mechanical drawings, for construction details, and coordinate the electrical work with that of other contractors to the end that unnecessary delays and conflicts will be avoided.

3.3 MATERIAL HANDLING

- A. Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

3.4 CUTTING AND REPAIRING

- A. Provide all required digging, cutting, etc. incidental to the Electrical Work. Make required repairs thereafter to the satisfaction of the Architect.
- B. Perform excavation in accordance with Division 2 Specifications.
- C. Do not cut into any major structural element, beam or column, without written approval of the Architect.

- D. Install the Electrical Work to proceed with other trades in order to avoid unnecessary cutting of the construction.

3.5 CONSTRUCTION REVIEW

- A. The Owner, Architect and/or Consulting Engineer will perform construction review throughout the construction of the project. The construction review does not relieve the contractor from the responsibility of providing all materials and performing the work in accordance with the Contract Documents.
- B. Notify the Architect in writing, giving ample notice, at the following stages of construction and allow the Owner, Architect and/or Engineer to review the installed work.
1. When underground electrical work is complete, before backfilling, including work under floor slabs.
 2. When all electrical rough-in is complete, but not covered.
 3. Pre-Final, upon completion of all electrical work.
 4. Final, upon completion of all items noted in the Pre-Final Construction Review Report.
- C. Prerequisite for Final Electrical Construction Review:
1. Electrical Engineer/Consultant must be present.
 2. Electrical Contractor's job foreman must be present.
 3. DFCM Representative must be present.
 4. Service Disconnect and all Panelboard Enclosures must be open, including existing panelboards.
 5. Clear access must be provided to all devices and equipment.
 6. All panels, disconnects, etc. must be labeled and typed panel index cards installed.
 7. All light fixtures, outlets, equipment, etc., must be energized and operable.
 8. Contractor must have pad and pencil to list all deficient items.
 9. Make all corrections and adjustments after the Final Construction Review, not during. Items requiring correction will appear on the Final Construction Field Report.
 10. Contractor must have all required keys to provide access to all panels and doors.
- D. Test all systems and equipment provided and/or connected under the Contract for short circuits, ground faults, proper neutral connections and proper operation in the presence of the Owner, Architect and/or Engineer.
- E. The entire construction will be installed in accordance with the contract documents and be free of mechanical and electrical defects prior to final acceptance of the work.

* END OF SECTION 16000 *

SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Division 1 Demolition Sections.

1.2 SCOPE

- A. Remove electrical equipment and wiring systems and make required extensions and reconnections as shown on Drawings and specified herein.
- B. Repair all damage resulting from demolition and extension work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide new materials and equipment for patching and extending work as specified in the appropriate Specification Section for the materials and equipment involved.
- B. Where materials or methods not included in the Specifications are required, provide materials and methods in accordance with normal construction industry standards and as approved by the Architect and/or Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify existing measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on field observation of existing surface conditions. Report discrepancies to the Architect before disturbing existing installation.
- D. All demolition and extension work is not necessarily indicated on Drawings. Include all such work without additional cost to Owner.

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with Owner.

- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use electricians experienced in such operations.
- D. Protect all existing electrical equipment to remain from damage during demolition and new construction. Survey all existing equipment prior to beginning work and document in writing any existing damage to existing equipment.

3.3 DEMOLITION

- A. Coordinate with Owner for equipment and materials to be removed by Owner or salvaged by the contractor for Owner. Place salvaged equipment and materials in storage at the project site as directed by the Owner.
- B. Legally dispose of all removed equipment and materials not salvaged for the Owner.
 - 1. Existing fluorescent lamp ballasts are assumed to be free of PCBs. The contractor shall verify that ballasts are free of PCBs with the ballast manufacturer prior to disposal. Any additional cost for hazardous material disposal will be negotiated under the change order provisions of the contract, or the Owner will assume responsibility for legal disposal of the ballasts.
- C. Remove abandoned wiring to source of supply, i.e. panelboard, circuit breaker, etc..
- D. Remove accessible abandoned conduit, cables, junction boxes, etc., including above accessible ceilings. Cut conduit flush with walls and floors.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes and conduit servicing them where indicated on drawings. Provide blank cover for abandoned outlets which are not indicated to be removed.

3.4 EXTENSION OF EXISTING ELECTRICAL WORK

- A. Reconnect existing equipment where demolition interrupts existing branch circuits or feeders to the equipment.
- B. Repair adjacent construction and finishes damaged during demolition and extension work to match surrounding surfaces.
- C. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- D. Extend existing installations using materials and methods as specified for new work. Remove and replace existing installations which are not compatible with new work.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide new typed circuit

directory showing revised circuiting arrangement.

3.6 INSTALLATION

- A. Install relocated materials and equipment as required for new materials and equipment.

3.7 OUTAGES

- A. Maintain Existing Electrical Systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and connections. Minimize outage duration.
- B. Obtain permission from Owner and/or Architect before partially or completely disabling systems in accordance with Division 1 Specification Sections.

* END OF SECTION 16060 *

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide a complete raceway system for all wiring as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Provide minimum 3/4" trade diameter raceways for all wiring systems.
 - 1. Minimum 1/2" trade diameter raceways may be used for remote control, signaling and power-limited circuits which meet the requirements of National Electrical Code Article 725 as allowed in other Specification Sections and/or as approved by the Architect.
- B. Do not use aluminum conduit, intermediate steel conduit (IMC), BX cable, MC cable, Flexible Non-metallic Tubing, NM cable, Direct Burial Cable or any other wiring methods not allowed by this specification unless approved in writing by the Architect and/or Engineer.

2.2 ABOVEGROUND RACEWAYS

- A. Provide Electrical Metallic Tubing (EMT), galvanized inside and out, for raceways not subject to permanent moisture or damage.
- B. Provide Galvanized Rigid Steel Conduit (GRC) where raceways are subject to permanent moisture such as underground, or damage such as vehicular traffic, etc..

2.3 UNDERGROUND RACEWAYS

- A. Provide Schedule 40 PVC electrical conduit in earth or in concrete in contact with earth.
 - 1. Provide a separate ground wire in all PVC conduits, except main electrical service conduits.
 - 2. Provide Galvanized Rigid Steel Conduit (GRC) for all bends greater than 22 degrees in PVC conduits.
 - 3. Do not use PVC conduit above grade nor for penetrations through structural elements such as foundation walls, floor slabs, etc..
- B. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through floor slab or grade to extend minimum 12" above floor or grade.

- C. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through foundation walls to extend minimum 36" beyond the foundation wall.
- D. Corrosion protect all galvanized rigid steel conduit (GRC) installed in earth or in concrete in contact with earth with two (2) half-lapped layers of 0.010" thick approved waterproof PVC tape equal to Scotch No. 50 or use factory PVC coated rigid steel conduit with all field joints coated after installation.

2.4 FLEXIBLE RACEWAY CONNECTIONS

- A. Provide Flexible Steel Conduit for final connection to motors and other equipment subject to vibrations or movement, not to exceed 3 feet in length.
- B. Provide liquid-tight flexible steel conduit outside and in wet, humid, corrosive and oily locations.
 - 1. Provide Sunlight Resistant liquid-tight flexible steel conduit outdoors.
- C. Provide a ground conductor in all flexible steel conduit.
- D. Flexible Steel Conduit may be used where misalignment or cramped quarters exist only with prior approval of the Architect and/or Engineer.
- E. Flexible Steel Conduit may be used to fish through existing walls and ceilings only with prior approval of the Architect and/or Engineer.

2.5 CONDUIT FITTINGS

- A. Provide steel compression type or steel set screw type fittings for Electrical Metallic Tubing.
- B. Provide malleable iron clamp type fittings for Flexible Steel Conduit.
- C. Provide steel compression type fittings for Liquid-Tight Flexible Steel Conduit.
- D. Provide threaded fittings for GRC conduit. Provide double locknuts and plastic bushing for GRC conduit terminations or provide boxes and enclosures with threaded hubs.
- E. Provide liquid-tight and gas-tight conduit fittings underground using fittings and PVC cement as recommended by the conduit manufacturer.
- F. Provide steel rain-tight, compression type fittings for all conduit installed outside and in wet, humid, corrosive and oily locations.
- G. Provide Insulated Throat Connectors for all conduit terminations 1" diameter and smaller. Provide insulating bushings for all conduit terminations 1-1/4" diameter and larger.
- H. Provide Grounding Bushings bonded to the electrical system ground:
 - 1. On each end of all service conduits.

2. On each end of all feeder conduits in which a separate ground conductor is installed.
 3. On each end of all conduits used to protect ground conductors.
 4. On all conduit terminations installed in concentric or eccentric knockouts or where reducing washers have been installed.
- I. Do not use cast metal or indenter type fittings. Do not use screw-in type fittings for Flexible Steel Conduit. Do not use spray (aerosol) PVC cement.

2.6 RACEWAY SEALS

- A. Seal all conduit penetrations through fire rated walls, ceilings and floors with a UL classified fire barrier system in accordance with Division 7 Specifications.
- B. Seal all conduit penetrations through airtight spaces and plenums with an approved mastic compound acceptable to the Architect to prevent air leakage.

2.7 PULL BOXES

- A. Provide pull boxes or conduit bodies in accessible locations where required to reduce the number of bends in the conduit run to less than 360 degrees and at points not exceeding 100 feet in long branch circuit conduit runs.
 1. Indicate exact location of pull boxes and conduit bodies on the As-Built Record Drawings.

2.8 PULL STRING

- A. Provide a nylon or polypropylene pull string with not less than 200 lb tensile strength in all spare conduits and conduits installed for use by others. Provide a hard cardboard tag for each raceway to indicate location of the opposite end of the raceway.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Securely support all raceways with full (2 hole) pipe straps, hangers, or ceiling trapeze directly from building structure such as roof trusses, beams, floor joists, etc., in accordance with Specification Section 16190 - Supporting Devices.
 1. Do not support raceways from other electrical systems or mechanical systems.
- B. Provide supports at 5'-0" on center with a minimum of two supports for each ten foot length of conduit or fraction thereof up to 6 feet.
- C. Provide a support within 12" of each coupling, fitting, box, enclosure and bend.
 1. Install supports at vertical to horizontal conduit bends on the upper side of the bend.
- D. Provide support method for parallel conduit runs as follows:

<u>No. of Conduits</u>	<u>3/4" to 1-1/4" Conduits</u>	<u>1-1/2" and larger Conduit</u>
2 3 or More	Full Strap, Clamp or Hanger Mounting Channel (Trapeze)	Mounting Channel Mounting Channel

3.2 INSTALLATION

- A. Raceway layouts on the drawings are generally diagrammatic and the exact routing of raceways will be governed by structural conditions and the work of other contractors.
- B. Install raceways concealed within finished ceilings, walls and floors except where exposed raceways are specifically shown on the drawings or permitted by the Architect.
- C. Install exposed raceways parallel with or perpendicular to walls and ceilings, with right angle turns consisting of symmetrical bends or conduit bodies equal to Crouse-Hinds "Condulet". Avoid all bends and offsets where possible.
 - 1. Paint all exposed raceways to match surrounding surfaces in accordance with Division 9 Specification Sections.
- D. Install raceways minimum 12" from insulation of hot water piping, steam piping and other systems or equipment with temperatures in excess of 104° F (40° C).
- E. Make all field bends and offsets with a radius not less than allowed by the National Electrical Code for the type of raceway system.
 - 1. Do not install bends or offsets which are flattened, kinked, rippled or which destroy the smooth internal bore or surface of the conduit.
- F. Cap the open ends of raceways during construction to prevent the accumulation of water, dirt or concrete in the raceways. Thoroughly clean raceways in which water or other foreign matter has been permitted to accumulate or replace the raceway where such accumulation cannot be removed by a method approved by the Architect and/or Engineer.
- G. Install raceways for parallel feeder conductors with the same physical characteristics and in exactly the same manner. Maintain spacing between raceways for entire run.
- H. Do not install raceways which have been crushed or deformed in any manner.
- I. Do not install wiring until work which might cause damage to the wires or raceways has been completed.

3.3 UNDERGROUND RACEWAY INSTALLATION

- A. Install underground raceways within buildings minimum 4" below the bottom of the concrete floor slab to the top of the raceway.
- B. Install underground raceways outside of building minimum 24" below finished grade to the top of the raceway.

1. Provide a plastic red magnetic warning ribbon stating "CAUTION - BURIED ELECTRICAL" 12" directly above the top of the raceway.
- C. Use select granular fill, free of rocks or hard clumps with sharp or angular edges, for the first 6" of backfill around underground raceways including raceways below concrete floor slabs. Provide imported sand backfill where required by Division 2 Specifications or where excavated materials are not suitable.
- D. Secure underground raceways in place prior to pouring concrete encasement by means of duct spacers spaced at points not more than 5'-0" on center. Spacers shall maintain spacing of raceways as indicated on the drawings.
 1. Provide concrete for medium voltage cables with a red fugitive dye. Concrete encasement shall be not less 3" on sides, top, and bottom of conduits.
- E. Coordinate location of underground raceways with the General Contractor to avoid areas where raceways may be damaged by subsequent installation of trees, shrubbery or other landscape vegetation.
- F. Install underground raceways minimum 3'-0" from parallel runs, and minimum 1'-0" from perpendicular runs, of underground natural gas and propane lines.
- G. Do not use torches to heat PVC conduit for field bends. Do not install PVC conduit that has been scorched by heating for bends.

* END OF SECTION 16110 *

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all conductors for power and lighting as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Provide Copper building wire, minimum #12 AWG, with type THHN/THWN or XHHW 600 volt insulation, except as otherwise noted on the drawings or required by NEC.
 - 1. Provide conductors in underground raceways with insulation approved for wet locations such as type THWN or XHHW.
- B. Provide stranded conductors for wires #8 AWG and larger and for terminal connections to all motors. Stranded or solid conductors may be used for sizes smaller than #8 AWG at the contractor's option.
- C. Provide conductors rated 90⁰ C minimum in wiring channels of Fluorescent and High Intensity Discharge lighting fixtures.
- D. Provide conductors with surface printed identification showing conductor size and material, insulation type, voltage rating and approvals at regularly spaced intervals of 24".
- E. Do not use sizes smaller than #12 AWG in branch circuits carrying load. Circuits requiring larger sizes to meet voltage drop conditions, etc., are indicated on the drawings.
 - 1. Where branch circuit homeruns indicate conductor size, use that size conductor for the entire branch circuit, including switch legs, etc.
- F. Do not use aluminum conductors.

2.2 SPLICES

- A. Provide Ideal wirenuts or Scotchlock spring connectors for all conductor splices #8 AWG and smaller. Provide split-bolt or compression type connectors for all conductor splices larger than #8 AWG.
- B. Provide splices which are UL listed for the type, quantity and size of the conductors to be spliced.

- C. Provide all splices with insulation at least equal to that of the conductor.
- D. Provide watertight splices in junction or outlet boxes located outside and in wet locations. Provide heat shrink insulating kits or use connectors pre-potted with an approved waterproof compound.
- E. Splice conductors only in approved boxes.
- F. Do not splice conductors in conduit bodies, panelboard enclosures, switchboard enclosures, or similar locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all conductors in approved raceway systems.
- B. Install branch circuit conductors continuous without splice from panelboards to fixture outlet boxes, device terminals, etc..
 - 1. Provide suitable pull boxes in readily accessible locations where necessary at intermediate points of branch circuits. Indicate exact location of all boxes on the As-Built Record Drawings.
- C. Cut parallel feeder conductors to exactly the same length for each phase, neutral and ground prior to installing the conductors.
 - 1. Install all phase conductors, neutral conductor and ground conductor in each conduit of parallel feeders.
 - 2. Terminate each conductor of each phase, neutral and ground in exactly the same manner including type of connector and torque tightening of the connectors. Provide multi-conductor lugs for conductor termination where possible, suitable for the quantity and size of conductors.
- D. Do not install wiring until work which might cause damage to the wires has been completed.

3.2 COLOR CODING AND IDENTIFICATION

- A. Color code all wiring at each enclosure and box where conductors are accessible and at each splice, tap or termination by means of colored conductor insulation.
 - 1. For conductors #6 AWG and larger, colored self-adhesive tape with the appropriate color designations may be used.
- B. Color code each conductor of each circuit as follows.
 - 1. Ground: Green or Bare Copper
 - 2. 120/208 Volt, 3 Phase, 4 Wire System
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue

d. Neutral - White

C. Color code switch legs and travelers according to phase with colors other than used for phase conductors, to be consistent throughout the project.

3.3 IDENTIFICATION

A. Provide conductor identification in accordance with Specification Section 16195 - Electrical Identification.

3.4 MULTI-WIRE BRANCH CIRCUITS

A. Where a common neutral is run for multi-wire branch circuits, connect phase conductors to separate phases such that the neutral conductor will carry only the unbalanced current. Use neutral conductors of the same size as the phase conductors unless specifically noted otherwise.

B. Do not install more than three phase conductors in any raceway except where specifically shown on the drawings or approved by the Architect and/or Engineer.

3.5 PHASE ROTATION

A. Phase rotation for Three Phase System will be A leads B Leads C from front to back, from left to right or from top to bottom as viewed from the front of the enclosure.

* END OF SECTION 16120 *

SECTION 16130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide junction boxes and outlet boxes at each outlet, fixture and other device location as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 OUTLET AND DEVICE BOXES

- A. Provide galvanized or cadmium plated sheet steel electrical boxes in indoor dry locations, of the most suitable size and shape for the conditions encountered and in accordance with NEC requirements for the number of conductors allowed.
- B. Provide minimum 4" Square or Octagonal, 1-1/2" Deep Boxes unless specifically indicated otherwise on the drawings.
 - 1. Provide minimum 4" Square or Octagonal, 2-1/8" Deep Boxes where Three (3) conduit connections are required.
 - 2. Provide minimum 4-11/16" Square, 2-1/8" Deep Boxes where Four (4) or more conduit connections are required.
 - 3. Provide gang boxes where more than one device is located at the same point.
 - 4. Boxes smaller than 4" Square or Octagonal, even though of equivalent cubic inch capacity, are not acceptable.
- C. Provide Type FD cast metal boxes outside, in wet, humid or corrosive locations and where exposed to damage such as vehicular traffic.
- D. Confer with the various equipment suppliers and either use or properly provide for boxes which are furnished with the equipment, such as speakers, horns, bells, etc..
- E. Do not use "THRU-THE-WALL" boxes, sectional (gangable) boxes or non-metallic boxes.

2.2 JUNCTION BOXES

- A. Provide junction boxes as specified for outlet and device boxes except that boxes 6" square and larger may be painted sheet steel.

2.3 BOX ACCESSORIES

- A. Provide fittings, plaster rings, cover plates and other accessories suitable for the purpose and location of each box.
- B. Provide plaster rings which are minimum 1/8" deeper than wall covering for flush mounted boxes (i.e. use 3/4" plaster ring for 5/8" gypsum board wall covering) such that plaster ring will be flush with finished face of wall.
- C. Provide industrial raised covers for surface mounted outlet and device boxes.
- D. Provide masonry rings for boxes installed in brick walls, concrete block walls and in walls with tile finish.
- E. Provide ceiling outlet boxes with standard 3/8" fixture stud where required for fixture to be installed.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Support each box from the building structure independent of the raceway system.
- B. Support flush mounted wall boxes with metal bar hangers or metal stud backing behind the box secured to wall studs.
- C. Support flush mounted ceiling boxes with metal bar hangers secured to ceiling support system or threaded rod hangers secured to structure.
 - 1. Secure boxes for box supported fixtures to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater.
- D. Secure surface mounted boxes to building structure with minimum of 2 screws or bolts as required.
- E. Do not use side mounted boxes or brackets.

3.2 INSTALLATION

- A. Install flush mounted boxes, after being equipped with extensions, accessories, etc., flush with finished face of wall, ceiling or floor.
 - 1. Replace or repair all boxes not installed flush with finished surfaces to the satisfaction of the Architect and/or Owner.
 - 2. In order to meet this requirement, it is recommended that the Electrical Contractor be present during installation of gypsum board, tile or other wall coverings.
 - 3. Coordinate depth of wall coverings to be installed on all walls with the General Contractor prior to installing plaster rings.
- B. Install boxes in opposite sides of common room walls in adjacent stud spaces where possible and

with minimum 6" separation between the boxes. Provide minimum 10" of conduit between boxes which are connected by conduit.

- C. Install outlet boxes for light switches on the strike side of door openings. Coordinate door swings with the General Contractor prior to roughing in switch boxes.
- D. Seal around the surface of all switch and outlet boxes with plaster or grout to close any opening between the outlet box and the wall finish.
- E. Install boxes level and plumb.

3.3 LOCATIONS

- A. The wiring system layouts on the drawings are generally diagrammatic and the location of outlets and equipment are approximate.
- B. Study all available drawing details, shop drawings, equipment drawings, building conditions and materials surrounding each outlet and device box prior to installing the box to ascertain the exact location required for each box.
- C. Rough in the electrical work such that electrical outlets, fixtures and other fittings are properly fitted to the work of other trades.
- D. Do not install boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.
- E. The right is reserved to make any reasonable change in the location of the outlets before roughing in, without involving additional expense.

3.4 MOUNTING HEIGHT

- A. Install outlet and device boxes at the heights shown on the drawings or as directed by the Architect. In general, mount outlets as follows.
 - 1. Convenience Outlet 18"
 - 2. Wall Switch 46"
- B. All mounting heights, including mounting heights indicated on drawings, are to the center of the outlet box above finished floor or grade unless noted otherwise.
- C. Refer to applicable Specification Sections for mounting heights of devices and equipment not included above or install at heights as directed by the Architect and/or Engineer.

* END OF SECTION 16130 *

SECTION 16140 - OUTLETS AND WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all wiring devices complete with coverplates and necessary accessories as shown on the drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide submittals for each type of wiring device to be used on the project in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the contract documents.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Provide wiring devices rated 20 amps minimum, as specified below, or equivalent of Eagle, General Electric, Hubbell, Leviton or Pass & Seymour.

- | | |
|---|----------------|
| 1. Switch, Single Pole | Bryant 4901 |
| 2. Receptacle, duplex convenience, 3-wire | Bryant 5352 |
| 3. Receptacle, duplex, GFCI protected | Bryant GFR53FT |

- B. Color of devices in finished areas will be as selected by the Architect from the manufacturer's standard colors to compliment the color of architectural finishes.

- C. Provide convenience outlets with GFCI protection in accordance with NEC requirements, where installed outside or within 6 feet of any sink and as indicated on the drawings.

- 1. Provide a self-adhesive printed label stating "GFCI PROTECTED" for each outlet protected by feed-through GFCI receptacles or GFCI circuit breakers.
- 2. Use feed-through GFCI outlets only to protect other outlets within sight of the GFCI protected outlet.

2.2 COVERPLATES

- A. Provide a cover plate for each outlet and box suitable for the location and function of the outlet and box.
- B. Provide blank cover plates for junction boxes and outlet boxes not used.

- C. Provide nylon or impact resistant thermoplastic coverplates for outlets and boxes installed in finished areas, of the same manufacturer and color as the wiring devices.
- D. Provide UV Stabilized Polycarbonate, "Raintight While In Use" coverplates with spring return lids and suitable gasket as manufactured by Eagle or Taymac for all devices installed outside or in wet locations.

2.3 ACCESSORIES

- A. Equip each outlet with devices suitable for the purpose of the outlet and with means of properly connecting the equipment served, whether or not such devices are specifically mentioned.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Properly locate each outlet to fulfill its particular purpose. Do not install receptacles or boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.
- B. Install all outlets and wiring devices flush with face of coverplate, with the coverplate in contact with the finished face of the wall and with mounting strap of device in contact with the outlet box.

* END OF SECTION 16140 *

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide suitable supporting devices for all electrical equipment, raceways and components as specified herein and as shown on the drawings.
- B. Refer to individual specification sections for additional supporting requirements.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Provide support anchors which will support in tension a minimum of 4 times the weight of the equipment to be supported but not less than 100 lbs.
- B. Provide wood screws in wood; toggle bolts in hollow masonry units; expansion bolts with lead shield or shot anchors in concrete and brick; and machine screws, threaded 'C' clamps or spring-tension clamps on steel work.
- C. Do not use tie wire for support unless specifically called for in individual specification sections.
- D. Do not use threaded C Clamps on tapered steel sections.
- E. Do not weld supports, equipment, boxes, raceways, etc., to steel structures.
- F. Do not use wooden plugs or plastic inserts as a base for supports.
- G. Do not use shot anchors or drilled anchors of any kind in prestressed or post-tensioned concrete slabs and beams except as approved in writing by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Secure supporting devices to building structure.
- B. Do not install supporting devices with sheetrock or plaster as the sole means of support. Provide proper blocking behind the sheetrock or plaster as required to support equipment.

* END OF SECTION 16190 *

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide identification of all electrical equipment, devices, enclosures, conductors, cables, etc., as shown on the drawings and as specified herein.
- B. Refer to individual specification sections for additional identification requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Provide engraved laminated micarta or plastic nameplates to identify each panelboard, cabinet, motor starter, disconnect, etc., with the following minimum lettering heights:
 - 1. Switchboards, panelboards, etc. - 3/8"
 - 2. Disconnects, motor starters, etc. - 1/4"
- B. Provide Black Nameplates with White Lettering unless noted otherwise, or required to contrast with equipment enclosures.
- C. Do not use Dynamo Labels, printed labels, etc., unless specifically called for in other specification sections or approved by the Architect and/or Engineer.

2.2 EQUIPMENT IDENTIFICATION

- A. Provide engraved nameplates on the exterior of each Motor Starter, Safety Switch, etc., to include the Equipment Description, Number or Designation, and the Circuit from which the equipment is served.
 - 1. Example: AIR HANDLER AH-1
CIRCUIT M-5
- B. Provide engraved nameplates on the exterior of feeder and other major junction boxes and pull boxes to indicate the function of the wiring within the box such as "PANEL 'A' FEEDER" or "FIRE ALARM PULLBOX".

2.3 PANELBOARD IDENTIFICATION

- A. Provide one engraved nameplate on the exterior trim of each Panelboard, visible without opening the door, to include the Panel Designation and the System Voltage.

1. Example: PANEL 'A1'
120/208 V, 3Ø

B. Provide nameplates on each Branch Breaker of Distribution Panelboards to indicate the Panel or Equipment served by the Branch Breaker and the location of the Panel or Equipment.

1. Example: PANEL 'A1'
ELECTRICAL ROOM

2. Install the branch breaker nameplates on the wireway cover trim of panelboards. Do not install the nameplates on interchangeable dead-front trims.

2.4 TRANSFORMER IDENTIFICATION

A. Provide an engraved nameplate on the exterior of each Transformer to include the Transformer Designation and the power source for the transformer.

1. Example: TRANSFORMER 'T-5A'
SOURCE FROM XFMR 'T-5'

2.5 CONDUCTOR IDENTIFICATION

A. Identify each branch circuit and each feeder conductor at each outlet box, pull box, or other accessible location with hand lettering in black India ink in the enclosure to indicate panel and circuit numbers of all conductors in the enclosure.

B. Identify individual conductors with self adhesive printed markers equal to Thomas & Betts "E-Z Code" markers in outlet boxes, pull boxes, or other accessible location according to the circuit number in outlet boxes, pull boxes, etc., at the following locations:

1. Where circuit number of individual conductors cannot be determined by color coding, such as two or more conductors on the same phase.
2. Where more than one neutral conductor occurs, or where the neutral conductor is not common to all phase conductors, identify the neutral conductor according the associated phase conductor(s) circuit number(s).

2.6 PANELBOARD CIRCUIT INDEX

A. Provide a neatly typed index, to include type of load served and the specific location of the load for each branch circuit of each panelboard.

1. Provide a new typewritten index for each existing panelboard after field verification of existing branch circuits as indicated on the drawings.

B. Examples

1. Lighting, Southwest Conference Room
2. Lighting, 2nd Floor Conf. Rm and Office 208
3. Receptacles, SW Conf. Rm, west and north walls

- C. Do not use room numbers shown on plans, use room numbers or nomenclature assigned to rooms by the Owner. Do not use remarks from panel schedules on drawing, the remarks are for the Contractor's reference only.
- D. Include the panel designation and location of feeder breaker serving the panelboard at the top of the circuit index.
 - 1. Example: PANEL 'A1'
 MAIN IN PANEL 'M-8'

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install nameplates to be visible from normal viewing angles.
- B. Attach nameplates to equipment enclosures with stainless steel screws or rivets. Adhesives are not acceptable.
- C. Install panel index behind protective plastic covering.

* END OF SECTION 16195 *

SECTION 16300 - PRIMARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16400 - Secondary Service & Distribution

1.2 SCOPE

- A. Provide complete primary electrical service and distribution as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. The existing State Fairpark primary distribution system is 7,200/12,470 Volt, 3 Phase, 4 Wire, Grounded WYE primary distribution system.
- B. New secondary service voltages will be as indicated on the drawings.

2.2 PRIMARY ELECTRICAL SERVICE

- A. Provide new underground primary electrical service, complete from existing pad mounted transformer to new building distribution transformers, located as shown on the drawings and as detailed in the Single Line Diagram.

2.3 FEEDERS

- A. Sizes and connection of feeders are shown on the Single Line Diagrams. Feeders are sized to handle rated loads and to meet voltage drop conditions.
- B. Do not install conductors of different sizes or types in the same conduit except as specifically noted on the drawings.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate installation of electrical service with Owner prior to beginning work.

3.2 POWER OUTAGES

- A. Power outages to any portion of the existing Electrical Distribution System will not be allowed except on weekends, holidays and/or as directed by the Owner.

- B. Submit requests for power outages to the Owner in writing, a minimum of Seven (7) days prior to all proposed outages. Indicate areas and buildings which will be affected by the power outage and the expected length of the power outage.
- C. Do not take any power outages without the Owners written permission.

* END OF SECTION 16300 *

SECTION 16320 - PAD MOUNT DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide Pad Mounted, Oil-filled, Distribution Transformers as shown on drawings and as described herein.

1.3 STANDARDS

- A. Provide new transformers constructed and tested in accordance with the latest revision of ANSI C57 12.00, C57 12.20 and C57.90 for; 750 KVA and below, High Voltage, 15,000 Volts and below; Low Voltage, 600 Volts and below.
- B. Where NEMA and IEEE standards are established they shall also apply.

1.4 SUBMITTALS

- A. Provide submittals for each transformer in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.
- B. Include outline drawings indicating dimensions, location of external items, anchorage points, etc., for each transformer.
- C. Include literature for each transformer to describe construction details, materials, ratings, etc., of the following:
 - 1. Primary and Secondary Voltages
 - 2. Primary voltage adjustment taps
 - 3. KVA rating
 - 4. Basic Impulse Level (BIL)
 - 5. Core and windings
 - 6. Tank construction and sealing system
 - 7. Impedance
 - 8. Full Load and No Load Losses
 - 9. High Voltage Bush Wells
 - 10. Low Voltage Bushings
 - 11. Insulation
 - 12. Insulating Oil
 - 13. Nameplates
 - 14. Accessories
 - 15. Warranty

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide transformers manufactured by a member firm of NEMA who is regularly engaged in manufacturing transformers similar to those required for this project. Provide items substantially the same as items of manufacture which have been in successful use for not less than 5 years in projects and units of comparable size.
- B. Acceptable manufacturers, subject to compliance with contract documents, are ABB, Cooper Industries, General Electric, and Square D.

2.2 RATINGS

- A. Primary Voltage: 12,470Y/7,200 V, 3Ø, 4 W, Grd WYE
- B. Secondary Voltage: 208Y/120 V, 3Ø, 4 W, Grd WYE
- C. KVA Rating: 225 KVA
- D. Temperature Rating: 65° C above a 40° C ambient, Oil-Air Cooled
- E. Basic Impulse Level (BIL): 95 KV
- F. Impedance: 2.00% (nominal)

2.3 CONSTRUCTION

- A. Provide compartmental type, self-cooled, tamperproof and weatherproof transformers for mounting on a pad which comply with applicable NEMA and ANSI standards.
- B. Provide barrier between high voltage and low voltage compartments with separate doors for each compartment. Interlock doors to prevent access to the high voltage section unless the low voltage section door has first been opened.
 - 1. Provide doors with 3 point latching mechanism and vault type handle with provisions for a single padlock. Provide door stops to hold doors open.
 - 2. Provide grounding stud in each compartment.
 - 3. Provide compartments sized to meet the requirements of ANSI C57.12.26.
- C. Provide transformer tank construction that effectively seals the tank interior from the atmosphere but will allow entry for service.
 - 1. Provide sealing system to maintain integrity of the seal over an operating oil temperature range of -25° C to 105° C.
 - 2. Provide tank construction to withstand a minimum pressure of 7 PSI gauge without permanent

distortion.

- D. Provide core and winding material and construction to minimize transformer losses.
 - 1. Core material may be either silicon steel or amorphous.
 - 2. One piece core construction is desired. Provide minimum assembly joints, held together with bands and torqued bolts, where other construction is used. Crimped banding is not acceptable for ratings over 50 KVA.
 - 3. Provide 4 or 5 legged core construction with a separate high-voltage neutral bushing in the high-voltage compartment where a WYE-WYE, Three-Phase connection is indicated
 - 4. Windings may be copper or aluminum.
- E. Provide each transformer with lifting provisions of adequate strength, size and arrangement to permit lifting the transformer in an upright position when filled with insulating fluid.
- F. Provide each transformer with means to secure the transformer to a concrete pad, suitable for the IBC Seismic Zone in which the transformer will be installed.
- G. Provide each transformer with a durable corrosion resistant and scratch resistant outdoor finish meeting or exceeding EEI finishing requirements. Color shall be "Pad Mount Green".

2.4 HIGH VOLTAGE COMPARTMENT

- A. Provide dead front high voltage compartment to conform with ANSI C57.12.26 requirements with 200 Amp load break, externally clamped universal bushing wells.
- B. Provide 2 Position (ON-OFF) load break, gang operated, oil immersed switch with external operating handle for operation with distribution hot stick.
- C. Provide (2) 2-1/2 % full capacity taps above and below rated primary voltage with an external tap changer for de-energized operation.
- D. Provide Bay-O-Net type oil immersed thermal overload fuses with current limiting partial range back-up fuses which are externally replaceable.
 - 1. Interlock fusing with switches so that fuses can be removed only when the associated switch is in the OFF position.
 - 2. Provide fuses of type and rating as recommended by the manufacturer.
 - 3. Include complete operational set and spare set of fuses.
 - a. Turn over spare fuses to Owner prior to Substantial Completion.

2.5 LOW VOLTAGE COMPARTMENT

- A. Provide each transformer with side wall mounted secondary low voltage bushings including a full

capacity neutral (grounded conductor) bushing with the following ratings:

1. Insulation Class: 1.2 KV.
2. BIL: 30 KV.
3. One minute withstand: 10 KV.

B. Provide style H or J Spade secondary external terminations with four 9/16" holes on 1.75" centers arranged for vertical take-off of conductors.

1. Provide 4 hole mounted lugs suitable for connection of the secondary service conductors secured to the terminal spades with 1/2" bolts, hex head nuts and belleville washers.

2.6 INSULATION

A. Provide transformers with mineral oil conforming to IEEE C57.106.

B. Provide NON-PCB classified insulating oil with less than 0.5 parts per million (PPM) of PCB content. Provide each transformer with permanent NON-PCB label.

C. Provide insulating paper coated on both sides with thermosetting adhesive and properly cured prior to impregnating with oil or provide coils wound with conductors containing a thermosetting adhesive, properly cured to form an effective bond.

2.7 ACCESSORIES

A. Provide the following accessories with each transformer.

1. Nameplates to comply with ANSI standards C57 12.00 and C57 12.20 to include switch operating procedures, wiring diagram, gallons of insulating oil, manufacturer's name and address and all electrical ratings.
2. Dial type thermometer with resettable drag hand.
3. Liquid level gauge with resettable drag hand.
4. Drain valve with built-in sampling device.
5. Self actuating pressure relief device.
6. External anchorage brackets suitable for seismic zone 3.

PART 3 - EXECUTION

3.1 FACTORY TESTS

A. Prior to shipment of transformer, the manufacturer shall conduct standard factory tests in accordance with ANSI C57.12.90 and NEMA Standard TR-1 to include the following:

1. Ratio
2. Polarity

3. Phase Relation
4. Exciting Current
5. No Load Loss
6. Load Loss
7. Resistance Measurement
8. Impedance
9. Regulation (Calculated)
10. Applied Potential
11. Induced Potential

- B. Submit certified test reports to the Owner and Engineer upon completion of the tests.
- C. Notify the Owner and Engineer of any initial tests which do not meet the requirements of the above referenced test standards and of all corrective actions taken to overcome test failures. Corrective actions to overcome test failures are subject to acceptance of the Owner.

3.2 INSTALLATION

- A. Install transformers on concrete pads as detailed on the drawings. Carefully install units so as to not scratch finishes. After installation, inspect finished surfaces and touch up any scratches with a finish furnished by the transformer manufacturer prepared especially for this purpose.
- B. Secure transformers to concrete pads with a minimum of four 5/8" x 6" anchor bolts.

3.3 FIELD TESTS

- A. Upon completion of installation and prior to energization of the transformer, perform the following field tests:
 1. Ratio Test at rated voltages and each tap setting to verify winding ratios.
 2. Insulation resistance (Megger) tests at rated voltage for each voltage and tap setting to verify integrity of insulation and continuity of windings.
- B. Submit copies of all test reports to the Owner and Engineer. Immediately notify the Engineer of any test failures.

* END OF SECTION 16320 *

SECTION 16375 - MEDIUM VOLTAGE CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16110 - Raceways
- C. Section 16120 - Low Voltage Conductors

1.2 SCOPE

- A. Provide new copper conductors for the underground primary electrical distribution system as shown on the drawings and as specified herein.

1.3 STANDARDS

- A. The following standards shall form a part of this specification to the extent specified herein:
 - 1. AEIC CS-6 for Ethylene Propylene Rubber insulated shielded power cables.
 - 2. ICEA Publication S-68-516, NEMA Publication WC8 for Ethylene Propylene Rubber insulated wire and cable.
 - 3. UL Standard 1072 for Type MV-90 power cable.
 - 4. ASTM B-8, B-231
 - 5. IEEE 400-1980
 - 6. Federal Register, Section 10CFR50, Appendix B
 - 7. ANSI N45.2
 - 8. IEEE 48-1990
 - 9. IEEE/IPCEA Power Cable Ampacities, IEEE S-135

1.4 SUBMITTALS

- A. Provide submittals for medium voltage cables and terminations in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.
- B. Include manufacturer's data on electrical cable and connectors for use at the specified voltage.
- C. Submit sample test report for High Potential Testing of conductors.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE CONDUCTORS

- A. Low voltage conductors (600 volt and below) shall be as specified in Section 16120 -Conductors.

2.2 SINGLE CONDUCTOR MEDIUM VOLTAGE CABLE

- A. Provide cable with Class B stranded annealed copper conductor per Part 2 of ICEA.
- B. Cover the conductor with a layer of extruded conducting thermosetting compound, compatible with and firmly bonded to the cable insulation, in accordance with Paragraph D.1 and meeting the requirements of Paragraph D.5 of AEIC CS6.
- C. Apply a homogeneous wall of Ethylene Propylene Rubber insulation directly over the conducting extruded layer. The 133% insulation level thickness shall be 0.220 inches for 15 KV cable. The minimum thickness at any point shall be not less than 90% of the specified thickness. Physical and electrical properties of the insulation shall be in accordance with Paragraph 3.6 of ICEA.
- D. Apply an extruded conducting thermosetting insulation shield over the insulation. It shall be in intimate contact with the outer surface of the insulation and shall be free-stripping, leaving no conducting particles or other residue on the insulation surface. This layer shall be legibly identified as being conducting. The average thickness of this layer shall be in accordance with Table C3 of AEIC CS6 for 15 KV cable. The insulation shield shall meet the resistivity requirements of Paragraph C.5 of AEIC CS6.
- E. Helically apply a 5 mil annealed copper shielding tape with a minimum 20% overlap directly over the extruded insulation shield. This tape shall meet the requirements of Part 4 of ICEA.
- F. Apply a Polyvinyl Chloride (PVC) jacket overall. The jacket shall meet the requirements of Part 4 of ICEA and the sunlight resistant requirements of UL Standard 1072. The jacket thickness shall be as specified in Part 4 of ICEA. The minimum thickness at any point shall be not less than 80% of the specified thickness.
- G. Identify all cable by means of surface ink printing indicating manufacturer, size, insulation type insulation thickness, voltage rating, insulation level, year of manufacture and UL designations.
- H. Cables shall be factory tested in accordance with AEIC CS6, ICEA S-68-516 and UL Standard 1072.
- I. Acceptable manufacturers are Okonite, Pirelli, Rome, and Southwire.

2.3 SPLICES

- A. Cable splices will not be allowed except where specifically noted on the drawings and as approved in writing by the Engineer.

2.4 SEPARABLE CONNECTOR TERMINATIONS

- A. Where indicated on the drawings, terminate medium voltage cables with insulated separable connectors which meet the requirements of ANSI/IEEE Standard 386.
- B. Provide separable connectors with the following voltage ratings:
 - 1. Standard Voltage Class 15 KV
 - 2. Maximum rating Phase-to-Phase 14.4 KV
 - 3. Maximum Rating, Phase-to-Ground 8.3 KV

- | | | |
|----|------------------------------|-------|
| 4. | AC 60 Hz 1 Minute Withstand | 34 KV |
| 5. | DC 15 Minute Withstand | 53 KV |
| 6. | BIL and full Wave Crest | 95 KV |
| 7. | Minimum Corona Voltage Level | 11 KV |
- C. Provide 200 Ampere Load Break Elbows with the following current ratings:
- | | | |
|----|--------------------|--|
| 1. | Continuous Current | 200 Amperes |
| 2. | Switching Current | 10 Operations at 200 Amps RMS at 14.4 KV |
| 3. | Fault Closure | 10,000 Amps RMS symmetrical at 14.4 KV after 10 switching operations for 0.17 Seconds |
| 4. | Short Time | 10,000 Amps RMS symmetrical for 0.17 Seconds
3,500 Amps RMS symmetrical for 3.0 Seconds |
- D. Provide separable connectors which are dimensionally, mechanically and electrically interchangeable, whether used with parts of the same manufacturers or intermixed parts from several manufacturers.
- E. Provide separable connectors complete with conductor contacts, housing, hot stick pulling eye, voltage test point, grounding eye and cable shield adaptor for grounding of the medium voltage cable shield.
- F. Provide 200 Ampere single and feed-thru inserts with ratings as specified above where required for connection to equipment supplied with universal bushing wells.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all single conductor medium voltage cable in raceways as specified in Section 16110 - Raceways.
- B. Encase all underground medium voltage conduit in minimum of 3" of concrete with red fugitive dye.
- C. Bury all underground medium voltage conduits minimum 24" below finish grade to top of concrete encasement.
- D. Lace medium voltage conductors together according to each three conductor circuit where passing through manhole or pullbox and separate only where necessary for connections to terminals, taps or cutouts.
- E. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius.

3.2 IDENTIFICATION

- A. Provide warning signs on all exposed medium voltage conduit and cable stating "DANGER - 12,470 VOLT" at points not more than 10 feet apart. Provide signs equal to Thomas & Betts type WDA, self-adhesive vinyl markers.

3.3 FACTORY TESTS

- A. Factory tests shall be made on all high voltage cables consisting of AC and DC tests performed in accordance with ICEA S-68-516 and UL Standard 1072. Shield resistance to be measured and recorded from end to end on completed cable. Each reel of completed shielded power cable shall comply with maximum partial discharge in picocoulombs specified in AEIC CS-6.
- B. Include certified factory test reports with delivery of cable. Forward copy of report to Engineer prior to installation of cable.

3.4 FIELD TESTS

- A. Perform field tests on cables in accordance with NEMA WC8 and IEEE Standard 48 after installation of all cables, splices, and terminations but prior to connection to equipment. Isolate the cables as required prior to test by opening appropriate switches and disconnecting equipment.
- B. Test the conductor for continuity.
- C. Apply direct-current voltage on each phase conductor by connecting the conductor as one terminal and the grounds or metallic shielding as the other terminal. Use a DC tester specifically designed for the purpose, with overload current-limiting devices to limit short circuit current.
- D. Start High potential DC test for the new cable and equipment at zero volts and increase in 5,000 volts increments until the recommended maximum voltage is reached.
 - 1. Test voltage shall not exceed the recommendations of the above referenced standards unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing.
- E. Maintain each voltage step value for a period of five minutes or until the leakage current is stabilized, whichever is less.
 - 1. The leakage current shall be considered to be stabilized if the leakage current does not change more than five microamps in a 15 second period.
 - 2. When leakage current does not stabilize, stop the test and re-test the cable. If the second test does not stabilize, discontinue the test.
- F. Repair or replace any cable which fails testing due to a weakness of conductor insulation or defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections and perform a retest for acceptance.
- G. Keep written record of the test results, recording leakage current at 30 Second intervals for the first 5 minutes of the test and at 1 minute intervals thereafter. Include all necessary test information such as cable system identification, ambient temperature, weather conditions, current, voltage, cable length, size, etc.
 - 1. Forward written test report to Engineer within 2 days of testing.
 - 2. Include copies of all test reports in the Operation and Maintenance Manuals.

* END OF SECTION 16375 *

SECTION 16390 - PRIMARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16450 - Secondary Grounding

1.2 SCOPE

- A. Except where specifically noted otherwise, ground all non-current carrying metallic parts of electrical equipment, raceway systems and neutral conductor of the wiring system.

PART 2 - PRODUCTS

2.1 GROUND RODS

- A. Furnish copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment.

2.2 GROUND CONDUCTORS

- A. Use copper ground conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.
- B. Use insulated conductors for the grounded neutral conductor of medium voltage circuits. Insulation shall be 600 Volt, and approved for wet locations.
- C. Use minimum No. 4/0 AWG conductors for distribution transformer grounding.

2.3 GROUND CONNECTIONS

- A. Make all ground connections accessible, above ground or in ground well as shown on drawings.
- B. Make all aboveground ground connections with pressure type fitting in conformance with IEEE Standard 837
- C. Make all underground ground connections by means of exothermic welding equal to Cadweld or Thermoweld in strict accordance with the manufacturer's written instructions.

2.4 EQUIPMENT GROUNDING

- A. Equipment frames of metal-enclosed equipment, medium voltage cable shields at cable joints and terminations, metal splice boxes, and other noncurrent-carrying metal items shall be grounded unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Leave ground connections accessible for inspection.
- B. Install all grounding in accordance with the latest edition of the National Electrical Code and the National Electrical Safety Code.

3.2 GROUND RESISTANCE MEASUREMENTS

- A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Owner and Engineer.
- B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated number of ground rods, furnish and install additional ground rods, longer ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained, except that the total length of additional ground rods will not be required to exceed 50 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

* END OF SECTION 16390 *

SECTION 16400 - SECONDARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16110 - Raceways
- C. Section 16120 - Conductors

1.2 SCOPE

- A. Provide complete new electrical service with connections to existing electrical distribution system and equipment as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. The Secondary Electrical Distribution System will be 120/208 Volt, Three Phase, Four Wire, 60 Cycle for Lighting, Equipment, Appliances and Outlets.

2.2 SERVICE ENTRANCE

- A. Provide new underground electrical service conduit and conductors as shown on the drawings from the new main distribution panel to the new service transformer.

2.3 FEEDERS

- A. Sizes and connection of feeders are shown on the Single Line Diagram. Feeders are sized to handle rated loads and to meet voltage drop conditions.
- B. Do not install conductors of different sizes or types in the same conduits.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate electrical service and metering with Owner prior to beginning work.

3.2 FEEDERS

- A. Before or during final job site observation, check each panel feeder and main feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.3 POWER OUTAGES

- A. Power outages to any portion of the existing building will not be allowed except on weekends, holidays and/or as directed by the Owner.
 - 1. Submit written requests for power outages to the Owner not less than Seven (7) working days prior to all proposed outages.
 - 2. Do not take any power outages without the Owners permission.

* END OF SECTION 16400 *

SECTION 16440 - SAFETY SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16475 - Fuses

1.2 SCOPE

- A. Provide all disconnect switches required by NEC or local regulations as shown on drawings and specified herein.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Safety Switch type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each switch type. Clearly indicate all options, accessories, finishes, etc., to be provided with each switch type.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

- A. Provide NEMA KS1, Heavy Duty Type HD, horsepower rated, quick-make, quick-break enclosed load interrupter knife switches, fusible or non-fusible as required, with externally operable handle, lockable in the OFF position and interlocked to prevent opening front cover with switch in ON position.
- B. Maximum voltage, current rating and horsepower rating will be clearly indicated on a metal plate riveted or otherwise permanently fastened to the switch enclosure.
- C. Provide switches with NEMA 1 enclosures or where indicated as weatherproof, NEMA 3R enclosures.
- D. Provide fusible switches rated 600 amps or less with a UL listed rejection feature to reject all fuses except Class R fuses.

2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable safety switch manufacturers, subject to compliance with the contract documents, are Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each switch enclosure. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

- A. In general, mount safety switches 5'-0" above finished floor or grade to center of switch.
- B. For exterior disconnects at condensing units or packaged rooftop units, mount top of switch at the same height as the top of the unit but not less than 24" above grade or roof to the bottom of the switch.

3.3 IDENTIFICATION

- A. Provide an engraved nameplate for each switch in accordance with Section 16195 - Identification.
- B. Provide adhesive tag on inside door of each fused switch indicating NEMA fuse class and rating installed.

* END OF SECTION 16440 *

SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Ground all non-current carrying metallic parts of electrical equipment, raceway systems and the neutral conductor of the wiring system as shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

- A. Provide copper ground electrode conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.
- B. Provide an insulated equipment ground conductor in all raceways on the load side of the service disconnect.

2.2 GROUND CONNECTIONS

- A. Make the electrical service ground connection at the main service equipment and connect to metallic water service, metal building structure, and ground rods as shown on the drawings and in accordance with NEC Article 250, Part III.
- B. Bond the neutral conductor to electrical service ground system at the main transformer and the main service equipment only.
- C. Bond all interior metallic piping systems to the electrical service ground system.
- D. Make above ground connections by means of pressure connectors, compression connectors, clamps or other means which are UL Listed and classified as suitable for purpose.
- E. Make all underground connections by means of an exothermic welding process equal to Cadweld or Thermoweld, in strict accordance with manufacturer's written instructions and recommendations.

2.3 GROUND RODS

- A. Provide copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment where indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Leave ground connections accessible for inspection.
- B. Install ground rods minimum 8 feet into earth. Space adjacent ground rods minimum 6 feet apart.
- C. Provide a separate ground terminal for each ground conductor in each panelboard, switchboard, and similar electrical equipment enclosures.
- D. Install all grounding in accordance with the latest edition of the National Electrical Code.

3.2 GROUND RESISTANCE MEASUREMENTS

- A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Owner and Engineer.
- B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated ground electrodes, provide a supplementary ground electrode consisting of 3/4" x 10'-0" copper ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained. Total length of additional ground rods will not be required to exceed 30 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

* END OF SECTION 16450 *

SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide new panelboards and switchboards complete with all necessary accessories as shown on drawings and as specified herein.
- B. Provide new branch circuit breakers in existing panelboards to serve new branch circuits as shown on drawings.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Panelboard in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include dimensioned construction drawings for each Panelboard. Clearly indicate voltage, ampacities, breaker types, conduit entrance areas, materials, options, accessories, finishes, etc., to be provided with each Panelboard. Include Series-Rated verification where required.
- C. Include wiring diagram customer meter with literature for digital meter and accessories.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Provide dead front safety type panelboards, constructed in accordance with NEMA and UL standards, with plated aluminum or copper bus bars.
- B. Provide each panelboard with main circuit breaker, single lugs or double lugs for attaching feeder conductors and/or sub-feeder conductors as shown on the drawings.
- C. All panelboards to be 20" wide minimum.
- D. Provide panelboards with NEMA 1 enclosures unless indicated otherwise on the drawings.
- E. Arrange circuit breakers in double vertical row configuration with bolted bus connections.
- F. Provide panelboard fronts with concealed indicating trim clamps, concealed steel door hinges and a flush mounted combination latch and lock. Key all locks alike for all panelboards furnished for the project.
- G. Provide each panelboard with an approved circuit index holder with transparent protective cover on

the inside of panelboard door.

- H. Provide a ground bus in each panelboard with a separate terminal for connection of each feeder and each branch circuit ground conductor.
- I. Panelboard schedules as shown on drawings.

2.2 SWITCHBOARDS

- A. Provide deadfront type Main Distribution Switchboard constructed in accordance with NEMA and UL standards, suitable for use Service Entrance Equipment, totally front accessible.
- B. Front covers may be screwed on or hinged with removable hinge pins.
- C. Provide switchboard with plated aluminum or copper bussing of sufficient cross-sectional area to meet UL Standard 891 temperature rise and braced to withstand a short circuit current of 50,000 RMS symmetrical amperes. Connect bus supports and bus joints with hex-headed bolts and Belleville washers to minimize maintenance requirements.
- D. Provide the main distribution switchboard with a molded case main circuit breaker for the electrical service disconnecting means. Provide the main circuit breaker with adjustable solid state trip functions to include long time ampere rating, short time ampere pickup and delay, and instantaneous pickup and delay.
 - 1. Trip settings shall be field adjustable by means of rotary switches located on the face the breaker and protected by a sealable cover. Hand held programming devices are not acceptable.
- E. Provide group mounted molded case circuit breakers for all feeders as shown on the drawings. Mount circuit breakers in the switchboard to permit installation, maintenance, connections and testing without reaching over any line side bussing. Provide mounting hardware where spaces are shown on the drawings.
- F. Provide a customer metering compartment in the service entrance section of the main switchboard, connected for cold sequence metering.
 - 1. Provide the metering compartment barriered from all line side bussing with hinged doors, removable hinge pins and sealing provisions. Install wiring to door mounted devices such that doors will swing full open with all wiring installed.
 - 2. Provide current transformers with minimum 2.0 rating factor, installed to be accessible from the front of the switchboard and permit installation, maintenance, connections and testing without reaching over any line side bussing. Provide secondary wiring from the current transformers to the metering compartment.
 - 3. Provide a microprocessor based Digital Display Power Meter with stand alone capabilities mounted in the door of the metering compartment.
 - a. The meter shall provide instantaneous values for Current, Voltage, KW, KVAR, KVA, Power Factor and Frequency through a LED display in addition to maintaining historical

data for peak demand KW, demand Current, Kilowatthours and Kilovarhours in a non-volatile memory for display.

- b. The Power Meter shall be UL listed and suitable for use with standard 5 Amp current transformers and 120 volt potential transformers and shall provide current and voltage accuracy of $\pm 1\%$ of full scale.

2.3 CIRCUIT BREAKERS

- A. Provide thermal-magnetic type circuit breakers unless noted otherwise.
- B. Provide multi-pole breakers with trip elements in each pole and common trip handle.
- C. Provide "HACR" rated circuit breakers to serve heating, ventilating and air conditioning equipment branch circuits.
- D. Provide "SWD" rated circuit breakers to serve all lighting and outlet branch circuits.
- E. Plug-in breakers are not acceptable for use in panelboards except for replacement in existing load center type panels.

2.4 INTERRUPTING RATING

- A. Provide panelboards and switchboards with minimum short circuit current interrupting ratings as shown on the drawings.
- B. The interrupting rating of circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified for the panelboards.
- C. The minimum interrupting ratings of circuit breakers used as feeders and branches may be in accordance with UL 489 tested and certified series-connected circuit breaker combinations. All electrical equipment using the Series Rated circuit breaker combinations shall be clearly marked on the panel nameplate and feeder breaker indicating the same.

2.5 ACCEPTABLE MANUFACTURERS

- A. Acceptable panelboard manufacturers, subject to compliance with the contract documents, are Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each panelboard. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

- A. In general, mount panelboards 6 feet above finished floor or grade to top of panel.
- B. Where panelboard exceeds 6 feet in height, arrange the panelboard so that the top operating handle does not exceed 6'-6" above finished floor or grade.
- C. Floor mount distribution switchboards on 3" high concrete housekeeping pad and secure to floor and wall or structure.

3.3 IDENTIFICATION

- A. Provide nameplates and neatly typed circuit index for each panelboard and switchboard in accordance with Section 16195 - Electrical Identification.

* END OF SECTION 16470 *

SECTION 16475 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide fuses of the proper sizes and rating for each fusible switch as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 FUSES

- A. Provide UL Class L or UL Class R, current limiting fuses, rated for up to 200,000 amperes interrupting capacity.
 - 1. For branch circuits feeding motors, furnish UL Class RK5, Time-Delay fuses and for branch circuits other than motors, furnish UL Class RK5 non time delay fuses.
- B. Provide fuses which are a standard product of Bussman, Cefco, Gould/Shawmut, or Reliance.

2.2 SPARE FUSES

- A. Provide a 20 percent complement, but not less than three, of each rating of each type of fuse used on the project. Turn over spare fuses to the Owner during or prior to Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install only fuses of the same type and rating in each fusible switch.

3.2 COORDINATION

- A. Coordinate fuse sizes for packaged mechanical equipment with mechanical contractor. Provide fuse sizes as indicated on the equipment nameplate.

* END OF SECTION 16475 *

SECTION 16480 - MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide motor starters, pushbutton stations, and other necessary operating devices for all Motors and Equipment as shown on the drawings and as specified herein.
- B. Thermostats and similar control devices and control wiring for control of heating, ventilating and air conditioning equipment will be furnished and installed by the Controls Contractor under the provisions of Division 15 Specifications.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Motor Starter in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each starter type. Clearly indicate all sizes, ratings, control devices, options, accessories, finishes, etc., to be provided with each starter.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Unless otherwise noted herein or on the drawings, motors will be furnished under Division 15 Specification Sections.
- B. In general, motors 1/2 HP and smaller will be Single-Phase rated at 115 or 120 volt. Motors and equipment larger than 1/2 HP will be Three-Phase with nameplate rating of 200 or 208 volt when used on a 120/208 volt system.

2.2 MOTOR STARTERS

- A. Provide NEMA rated motor starters and control devices.
- B. Do not use IEC rated motor starters and control devices.

2.3 MANUAL MOTOR STARTERS

- A. Provide Square D Class 2510 type F, or equal, single phase manual motor starting switches with overload heaters for each single phase motor where indicated on drawings.

2.4 MAGNETIC MOTOR STARTERS

- A. Unless otherwise noted herein or on the drawings, magnetic motors starters will be furnished under Division 15 Specification Sections as part of packaged mechanical equipment.

2.5 ENCLOSURES

- A. Provide starters with NEMA 1 Enclosures where located in indoor normally dry locations.
- B. Provide starters with NEMA 4X enclosures where located in outside or in wet locations. Provide suitable drain for starters located outside in accordance with the manufacturers written instructions.

2.6 HEATER CHARTS

- A. Provide manufacturer's standard chart inside the door of each starter indicating overload heater types, sizes and ratings for the starter.

2.7 ACCEPTABLE MANUFACTURERS

- A. Acceptable motor starter manufacturers, subject to compliance with the contract documents, are Allen Bradley, Cutler Hammer, Furnas, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

- A. In general, mount individual motor starters 4'-0" above finished floor or grade to center of starter.

3.3 COORDINATION

- A. Give special attention to wiring and controls for two-speed motors or motors with special controls at no additional cost to the Owner.
- B. Determine exact location of all electrical devices controlling mechanical equipment in cooperation with the Mechanical Contractor in the field before roughing-in.

* END OF SECTION 16480 *

SECTION 16485 VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide new Variable (adjustable) Frequency (speed) drives, including vendor support, for induction motors as shown on the drawings and as specified herein. Applicable to induction motors, single or three phase, fractional to 500 HP.
- B. The VFD installation, and associated equipment coordination and interface shall be provided by a factory trained and certified VFD electrical contractor. Alternately, the electrical contractor may operate under the supervision of an engineer approved VFD/Power Quality Supplier for the installation of the VFD System and associated equipment.

1.3 DEFINITIONS

- A. Total Harmonic Distortion (THD). [Distortion Factor (harmonic factor)]: The ratio of the root-mean-square of the harmonic content to the root-mean-square value of the fundamental quantity, expressed as a percent of the fundamental.
 - 1. $THD = 100 \times \frac{\sqrt{\sum_{h=2}^{\infty} V_h^2}}{V_1}$ times the square root of the sum of the squares of all harmonic voltage or current amplitudes, all divided by the amplitude of the fundamental voltage or current.
- B. Power Factor - Total:
 - 1. The ratio of the total power input, in watts, to the total volt ampere input to the VFD/ASD.
- C. Power Factor - Displacement:
 - 1. The displacement component of power factor: the ratio of the active power of the fundamental wave, in watts, to the apparent power of the fundamental wave, in volt amperes (including the exciting current of the thyristor converter transformer).
 - 2. The Cosine of the angular difference between the zero crossing of the voltage wave and total current wave.
- D. Telephone Influence Factor (TIF): "For a voltage or current wave in an electric supply circuit, the ratio of the square root of the sum of the squares of the weighted root-mean square values of all the sine-wave components (including alternating current waves both fundamental and harmonic) to the root-mean-square value (unweighted) of the entire wave.
- E. Performance Measurement Point (PMP): The point of connection for performance testing measurements shall be the electrical power input terminals of the VFD on the line side of the filters or phase shifting transformer.

1.4 CODES AND STANDARDS

- A. Provide variable frequency drives which comply the latest edition of the following applicable codes and standards:
1. NEC (NFPA 70) National Electric Code, 2005 edition.
 2. ANSI/NEMA ICS 6 Enclosures for Industrial Controls and Systems.
 3. NEMA AB 1 Molded Case Circuit Breakers
 4. NEMA ICS 2 Industrial Control Device, Controllers and Assemblies.
 5. ANSI/UL-508 Standard for Electric Industrial Control Equipment.
 6. ANSI C37 Standards for Circuit Breakers, Switchgear, Relays, Substations, and Fuses.
 7. ANSI C57 Distribution, Power and Regulating Transformers. (Including Reactors.)
 8. IEEE Std. 100-1992 IEEE Standard Dictionary of Electrical and Electronics Terms.

1.5 SUBMITTALS

- A. Provide submittals for each VFD in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.
- B. Submit the following information:
1. Description of equipment and tests proposed to meet the power quality requirements of paragraph "Performance Verification Testing", including name and qualifications of the testing service consultant.
 2. Names and qualifications of engineering and technical personnel responsible for installation, start-up, testing, support, and warranty of the VFD systems.
- C. Submit detailed drawings of each VFD to include, but not be limited to, the following;
1. Dimensioned drawings showing accurately the physical size and construction details of the overall cabinets.
 2. Complete dimensioned drawings showing accurately the interior components including spacing between components and wire bending space per NEC.
 3. Electrical ratings of each component to include Maximum Voltage, Maximum Continuous Current, Overload Ratings, Short Circuit Current Interrupting Ratings, Etc..
 - a. Include UL Listing of each component to NEMA Standards. IEC Rated devices are not acceptable.
 4. Schematic wiring diagrams indicating how the equipment is internally and externally connected and interconnected.
- D. Submit performance characteristics of each VFD system indicating in detail how the equipment conforms to the performance requirements of this specification including, but not limited to, power factor, efficiency, voltage rise and radiated energy.

1.6 SOURCE QUALITY ASSURANCE

- A. All material and equipment used in the manufacture of each VFD shall be new and unused. Each component shall be individually UL Listed and Labeled where standards have been established for the component.
 - 1. The fully assembled VFD shall carry a UL label certifying compliance with UL-508 standards. An equivalent safety leveling program by ETL documenting compliance with these industry standards will be acceptable.
- B. The VFD system manufacturer shall have a quality assurance and testing program to include the following as a minimum:
 - 1. A visual inspection of all system components, wiring connections, and safety mechanisms.
 - 2. High potential testing on the completed drive including all accessory power components in accordance with UL-508 (two times the rated voltage plus 1000 volts AC for 60 seconds) using regularly calibrated high pot test equipment.
 - 3. A system test run using an actual motor accelerated and decelerated through the entire speed range.
 - 4. Functional testing of all control panel devices including switches, pilot lights, keypad, programmable functions and other control devices.
- C. Include copies of all factory tests with each VFD for inclusion in the project Operation and Maintenance Manuals.

1.7 VENDOR SUPPORT

- A. The vendor (supplier) shall demonstrate that local maintenance and spare parts support is available.
 - 1. The vendor shall certify all replaceable parts are available within 24 hours using surface transportation.
 - 2. Replaceable parts available within a 100 mile radius of the Project Site may be indicated in place of 24 hour availability.
 - 3. The parts stocking location address and phone number shall accompany the submittal and be included in the operation and maintenance manuals.
- B. The vendor shall demonstrate and certify that factory trained service technicians are available within a 100 mile radius of the Project Site and that response within 24 hours after a request for assistance is customary.
 - 1. To verify the availability of technician response, the vendor shall provide a directory of customers that can vouch for the response.

1.8 WARRANTY

- A. Provide a 1 Year Warranty for each VFD system in accordance with the General Conditions and Division 1 Specifications to include parts labor and travel expenses from the date of Substantial Completion.
- B. The warranty shall cover each entire VFD system including power devices, controllers, filters, etc., included as part of the system package.
- C. For equipment or components manufactured by other than the complete VFD system manufacturer, which comprise more than 25% of the cost of the VFD system, the original equipment manufacturer shall be identified with the nearest office and warrant obligation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Furnish Variable Frequency Drive systems manufactured by a supplier regularly engaged in the manufacture of Custom Drive Systems as specified herein.
- B. Submit written verification that the VFD Manufacturer has been engaged in the production and testing of VFD systems for not less than 5 years upon request of the Project Engineer.

2.2 LINE INPUT CHARACTERISTICS

- A. Refer to drawings for voltages available to operate each VFD.
- B. Drives shall accept the specified voltages continuously without damage, deterioration of performance, or life expectancy.
- C. Line frequency will be 60 Hz +- 1%
- D. Total power factor reflected into the line shall be greater than 95% at all loads and drive speeds. The power factor shall never be unity (100%), but may go leading if the voltage rise is not greater than 5% of the nominal line voltage and never exceeds the line tolerance limits.
- E. Efficiency shall exceed 95% at all loads and frequencies (speeds).
- F. The above requirements shall apply to common mode and transverse mode.
- G. As applicable to radiated energy, FCC part 15 applies without any exemption for industrial or commercial equipment.
- H. Line disturbances such as "notching" from other devices, harmonic distortion of line voltage from external sources, RF and other line disturbances shall not affect the drive performance.
- I. Power source characteristics are indicated on the drawings, to be verified by actual inspection.

2.3 LOAD CHARACTERISTICS

- A. Refer to Drawings for Loads to be connected to the VFD.

- B. Motor input voltage ratings shall conform to NEMA MG 1, but shall be operable on the line voltages indicated on the drawings.
- C. The Drive shall not require that the motor be rated for duty other than a standard induction motor. Motors specifically rated for VFD service shall not be required, but may be supplied.

2.4 DRIVE OUTPUT TO LOAD

- A. Drive output to load shall be Pulse Width Modulation (PWM).
 - 1. Current Source Inverter (CSI), Variable Voltage Inverter (VVI) Etc. are not acceptable.
 - 2. Drives using "Vector" output technology not using feedback from the motor may be given preferential consideration.
- B. Effective voltage output shall be proportional to the frequency of the output (V/Hz) to maintain minimum motor heating and drawn current.
 - 1. Above 60 HZ the output voltage shall remain constant at the 60 Hz value, or settable through internal programming.
- C. The drive shall be self protected for load faults or overloads. Motor starting currents shall not trip the protection system unless the duration of the overload exceeds the load time-current characteristic by 100%.
- D. Motor speed sensors, external to the drive, for feedback to the drive are not acceptable.
- E. The drive shall be capable of operating:
 - 1. Without a motor connected.
 - 2. When the motor is rotating at any speed and it is disconnected under no load to full load, no damage to the drive will occur.
 - 3. When the motor is rotating at any speed or direction, under no load to full load and it is connected to the drive, no damage to the drive will occur.
- F. The drive shall be capable of providing "ride through" for:
 - 1. a 6 cycle input power loss.
 - 2. voltage reduction to 60% of line voltage for 10 cycles.
 - 3. plus or minus 5% frequency variation.
 - 4. distorted line voltage up to 7% total harmonic distortion.
- G. Frequency of the output shall be adjustable from 0.5 to 120 Hz.
- H. The electrical voltage and current to the motor shall be such that the motor temperature rise is no more than 5% above 60 Hz operation temperature when the drive is operating at other than 60 Hz, and in no case above MG 1 para 12.42.1 or 12.43.

2.5 ELECTRICAL CONSTRUCTION

- A. The electrical construction of the drive shall be all solid state except where otherwise indicated.
 - 1. Drive control shall be by solid state microprocessor and memories as required.
- B. The drive solid state component assembly shall be manually by-passable and totally isolatable from the line/load voltages and currents.
 - 1. Protection, isolation, bypass circuit breakers and switches may be electro-mechanical devices. Breakers and switches may be automatic or manual as necessary to provide a safe and operable totally isolated and full load capacity by passed system.
 - a. All electro-mechanical devices shall be UL Listed to NEMA Standards for the type of device. IEC Rated devices are not acceptable.
 - 2. Unless otherwise deleted (where necessary by the external system design), the bypass device shall act as an automatic full capacity across the line, overload protected, motor starter with manually operable control.
- C. Protection shall be internal for overloads, line faults, ground faults, line surges, line under/over voltages, over temperature and semiconductor faults.
 - 1. A main disconnect and fault protection device located within the cabinet with an external operator shall disconnect all lines to the VFD from the line, including filters, transformers, inductors and bypass switches. The device may be a circuit breaker, fused switch (any fuse blowing shall operate all poles to provide all line disconnect), or motor circuit protector (MCP) rated at a minimum of 10,000 AIC at 240 Volt, 3 Phase, or as otherwise specified or approved. Manual operation and reset (except for fuses) shall be by a handle on the front of the cabinet door with padlock provisions on the handle.
 - 2. Motor overload shall be provided in the VFD through an electronic system incorporating instantaneous trip, inverse time trip and current limiting functions. These shall be optimized for the application and shall be adjustable.
 - 3. The VFD shall have incorporated within the control system under voltage (and loss of voltage) protection, over temperature protection of the VFD (overall and critical components), and loss of a single phase. Any condition indicated shall cause an orderly shutdown and cause the alarm indication and contact to activate.
 - a. Under voltage or loss of voltage shall re-set to start conditions with the return of normal voltage.
- D. Alarms for component failure, overload or from protective devices indicated shall be displayed on a diagnostic indicator and shall operate a single form "C" (spdt) dry electrical contact.
 - 1. The form "C" contact shall be rated at 120 V AC or DC at 5 amps and have all three leads brought to a terminal block rated for 150 VAC and 10 Amps minimum.
- E. The control panel shall contain a means of "hand-off auto" control independent of the control

keyboard.

- F. Restart from shutdown from a power failure, under voltage or other protection shutdown, shall occur upon return of line voltage to within operating voltage specifications, and when there is a remote control signal present or the control is in local (hand) control.
- G. Identified terminals shall be provided for line, load, external control, and external alarm connections that are consistent for the conductor sizes to be used and over sized for larger than current carrying capacity to account for line loss to the VFD and the motor.
 - 1. Wire bending and installation space for line/load terminals shall be provided in accordance with the NEC.
 - 2. All internal wiring shall be permanently marked with hot embossed stamping, shrink fit marked tubing or other pre approved marking system.
 - 3. Wiring identification and terminal identification shall be correctly documented on the drawings and in the Operation and Maintenance manual.
- H. Modular construction is required such that replaceable components, circuit board, etc. can be easily replaced in the field by technicians using conventional tools.

2.6 CONTROL

- A. Provide each VFD System with local manual controls and provision for remote control by signals from other vendors or sources.
 - 1. Provisions for remote control signals may include 4 to 20 Ma or 0 to 10 V.
- B. Control voltages for internal systems and indicators shall not exceed 120 VAC.
 - 1. Provide primary and secondary fused control transformers, sized larger than internal loads where external interlocks or other controls are indicated as special items.
- C. Forward and reverse control is not required.
- D. Hand-Off-Auto, local-remote, output frequency (speed) adjustment controls (if other than touch pad), and touch pads parameter settings shall be provided front cabinet accessible without opening the cabinet.
- E. Internal or touch pad parameter adjustments shall be included in the control system:
 - 1. Maximum and minimum speed (output frequency).
 - 2. Acceleration and deceleration times or ramp slope.
 - 3. Maximum motor voltage.
 - 4. A minimum of 3 frequency jumps for avoiding motor resonance.
 - 5. Motor over current trip point.

2.7 METERS, INDICATING DEVICES, INPUT DEVICES AND TOUCH PADS

- A. Metering for output frequency, voltage, and current shall be provided via the touch pad controller. (This does not indicate to measure the carrier frequency)
- B. Diagnostic meters and indicators may be a single indicating device and shall display any alarms or critical diagnostic information when not under the control of an operator.
- C. Hand-Off-Auto, local-remote, manual output frequency (speed) adjustment controls, and touch pads shall be industrial type oil tight devices and shall be mounted on the front panel such that they may be operated without opening the door.
- D. Indicating lamps shall be mounted on the front panel and include;
 - 1. power on.
 - 2. VFD operating.
 - 3. VFD fault.
 - 4. VFD bypassed.
- E. Fire Alarm shutdown shall be provided for shutting down the VFD controlling air supply fans when a fire alarm is activated. Possible methods are listed as follows, but other schemes may be submitted for evaluation.
 - 1. A 24 VDC relay located in the cabinet and controlled by the building fire alarm system, connected such that operation of the relay will cause the VFD to go to 0 Hz and disconnect power to the motor when the relay is activated by the Fire Alarm System. This operation shall occur whether the VFD is in Hand, Auto, or Bypass control.

2.8 ENCLOSURE

- A. The Enclosure system shall consist of an external cabinet and internal component or safety closures.
 - 1. The enclosure shall house all components of the drive including the drive, bypass switching, etc..
 - 2. Internal component closures shall provide a dead front design for all electrical components and open terminals to prevent inadvertent contact with live terminals or components when the door is open.
 - 3. The overall external enclosure may be a NEMA 1 or NEMA 12 enclosure, not exceeding 80 inches in height, with hinged and locking door.
- B. All front cabinet meters, switches and input devices shall be identified by a screened or engraved labels attached with screws or rivets (glue is not acceptable).
- C. Ventilation may be as required, natural or forced air for system operation in the encountered ambient environment.
- D. The overall cabinet may be wall or floor mounted.
- E. The overall cabinet shall have a finish that protects from corrosion.

F. A padlock locking system shall be provided for the overall cabinet door and may be part of the latching system of the door operating handle in the form of a padlock hasp.

1. The hasp with padlock shackle inserted shall prevent the handle from operating.

2.9 ENVIRONMENT

A. The drive shall be rated for 4,500 ft above msl with or without derating.

1. Where derating is required to achieve the altitude requirement, the de-rated capacity at 4,500 ft msl shall not be less than 125% of zero to full load and at all frequencies (speeds).
2. Verification of the drive rating in its enclosure at 4,500 ft msl without derating and where derated shall be provided by printed factory specifications.
3. Any drive not providing this verification shall not be acceptable and shall be rejected without further action.

B. The VFD shall be capable of operating in an ambient temperature range of 0° C (32° F) to 40° C (104° F).

C. The VFD shall be capable of operating in a Relative Humidity of 5% to 95% non condensing.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each drive enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.
- B. Provide additional supports for free standing enclosures from top of enclosure to the building structure.

3.2 INSTALLATION AND START-UP

- A. Install each VFD under the direction of a factory trained and authorized representative and in accordance with the manufacturer's written instructions.
 1. Verify all installed overload elements, fuses, circuit breakers, wiring, etc., are properly sized for the actual motor and drive.
 2. Verify interlock and control wiring is properly installed and the drive is able to be controlled by the building temperature control system.
- B. Each VFD shall be started by a factory trained and authorized service technician.
 1. Verify motor rotation is correct in all modes of operation.

2. Verify all operator devices, programming and monitoring function are fully operational.
 3. Verify operation of all field signal control connections.
 4. Measure and record system output voltage and current at 50% and 100% speed. Tune the output voltage to correspond to the motor nameplate rating at full speed. Check full load current measurements against motor nameplate data.
 5. Make all parameter adjustments to tune and optimize the drive system to the application. Record all configuration values for inclusion in the a report.
- C. Touch-up any scratched or marred surfaces of the drive enclosure with paint supplied by the manufacturer.
- D. Submit to the project engineer a signed copy of the start-up procedure report, certifying proper system operation prior to scheduling Performance Verification Testing.

3.3 PERFORMANCE VERIFICATION TESTING

- A. Provide the services of an acceptable service consultant to conduct performance verification testing at no additional cost to the owner.
1. The service consultant shall provide calibrated test equipment and trained operators to verify compliance with the requirements of paragraph "Line Input Characteristics" for the following electrical characteristics:
 - a. Voltage.
 - b. Line frequency
 - c. Total Power Factor
 - d. Harmonic Distortion
 - e. Efficiency
 - f. Radiated energy
 2. Test equipment shall be calibrated by an independent calibration laboratory with test equipment and procedures as required and traceable to the National Standard Institute (NSTI i.e. NBS).
 - a. A current calibration sticker indicating the date of calibration and the expiration or re-calibration date shall be affixed such that any tampering will destroy the sticker.
 - b. Test equipment shall be capable of measuring accurately through the 35th harmonic (2,100 HZ) and beyond.
- B. Test the VFD line input terminal under the following conditions:
1. Without the VFD connected or bypassed.
 2. With the motor running and driving its normal load with the VFD bypassed.
 3. With the VFD connected, the motor running and driving its normal load;
 - a. at 50% speed (30 Hz).

- b. at 75% speed (45 Hz).
- c. at 100% speed (60 Hz).

C. Any drive not meeting the requirements of this specification will be repaired or replaced at no additional cost to the Owner.

D. Submit written test reports to the Engineer within 2 working days of testing.

- 1. Include statement of compliance or description of characteristics which do not comply with the requirements of this specification.
- 2. Include graphical and text data of voltages and current wave forms, measured distortion, harmonic levels through the 35th harmonic, transformer derating and telephone influence factor (TIF).
- 3. Include description of test equipment used and calibration verification.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications. Provide separate manuals for each building involved in the project.
- B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.
- C. Include test reports and results including corrective action taken to comply with the requirements of this specification.
- D. Include complete operating procedures and maintenance procedures.
- E. Include complete certified as built schematics, wiring diagrams, ladder and logic diagrams.
- F. Include identification of and list of all replaceable parts.
- G. Include periodic service requirements with the service interval.
- H. Provide manuals in a hard back ring binder or the manuals may be included as a separate section of the Project Operation and Maintenance Manuals.

3.5 TRAINING

- A. Provide the services of competent instructors to instruct the owner's designated operating and maintenance personnel in the operation, maintenance, calibration, configuration, and programming of the VFD systems. Provide a training manual for each person which describes in detail the material included in the training program. Training shall include:
 - 1. System overview
 - 2. General theory of operation
 - 3. System operation

4. System configuration
5. Alarm formats
6. Failure recovery procedures
7. Maintenance and calibration
8. System programming and configuration

- B. Include instruction for between 4 and 6 people of not less than 4 hours nor more than 8 hours which shall include both classroom instruction and actual hands-on training.
- C. Date, time and place of training shall be coordinated with the owner and performed prior to substantial completion.
- D. Verification of training shall be certified in writing on a form acceptable to the owner. Include copies of the form in the operation and maintenance manuals.

3.6 COORDINATION

- A. Determine exact location of all electrical devices controlling mechanical equipment in cooperation with the Mechanical Contractor in the field before roughing-in.

* END OF SECTION 16485 *

SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all lighting fixtures, as shown on drawings and as described herein, complete with all necessary wiring, sockets, lamps, auxiliaries, supports, etc..

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Fixture and Ballast type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each fixture type. Clearly indicate all options, accessories, finishes, etc., to be provided with each fixture type.

PART 2 - PRODUCTS

2.1 FIXTURES

- A. Provide fixtures which comply with the appropriate Underwriters Laboratories (UL) Standards for the fixture type and which are UL Listed and UL Labeled.
- B. Acceptable fixture manufacturers and types are indicated on the Fixture Schedule included with the Drawings.
 - 1. Listing of the manufacturer's catalog numbers on the Fixture Schedule is intended to establish the general fixture type required and does not relieve the contractor and/or supplier from the responsibility to provide all accessories and options included in the fixture description nor from meeting the requirements of this specification.

2.2 FLUORESCENT BALLASTS

- A. Provide UL Listed, CBM-Certified by ETL, Premium Class 'P', Solid State Electronic, fluorescent ballasts with Class 'A' sound rating which meet the energy efficient requirements of Public Law 100-357 (National Appliance Energy Conservation Amendment of 1988 to the Energy Policy and Conservation Act of 1987) for the lamp types to be served by the ballast.
- B. Electronic Ballasts shall operate lamps at a frequency of 20 to 35 KHz with no detectable lamp flicker, shall comply with FCC and NEMA limits governing EMI and RFI, and shall not interfere with the operation of other normal electric and electronic equipment.

- C. Ballasts shall be potted, in a steel case and contain no PCBs. Operating temperature of the ballasts shall not exceed 60° C at any point on the case during normal operation.
- D. Provide fluorescent ballasts with the proper lamp circuit voltage and rating for the lamp types to be served by the ballast and with the following operating characteristics:
 - 1. Minimum Ballast Factor 0.88
 - 2. Minimum Power Factor 95%
 - 3. Maximum Total Harmonic Distortion (THD) 10%
- E. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing, CBM Certification and Date of Manufacture Code.
- F. Electronic Ballast Warranty shall be 5 Years from the "Date of Manufacture" Code on the ballast.
- G. Fluorescent Ballasts shall be of U.S. Manufacture. Acceptable Manufacturers, subject to compliance with Contract Documents, are Advance, Magnetek and Sylvania.

2.3 LAMPS

- A. Provide lamps of the Wattages, Types, and with color characteristics as indicated on the Fixture Schedule included with the Drawings.
- B. Provide fluorescent lamps which conform to the Energy Policy Act of 1992 and the applicable ANSI Designations for the lamp wattage and type.
 - 1. Fluorescent Lamps shall be compatible with supplied ballasts to meet the energy conservation requirements of Public Law 100-357.
- C. Provide new fluorescent lamps with reduced mercury content, such as Phillips "Alto" Series Fluorescent Lamps, to meet the requirements of the EPA Resource Conservation Recovery Act for Toxic Characteristic Leaching Procedure.
 - 1. Reduced mercury content lamps will not be required for lamp types which are not available from any of the acceptable lamp manufacturers with reduced mercury content.
- D. Acceptable Lamp Manufacturers, subject to compliance with the Contract Documents are General Electric, Phillips, and Sylvania.

2.4 EXTRA STOCK

- A. Provide the following extra stock of materials to the Owner.
 - 1. Lamps: 10% , but not less than 2 of each type used on the project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Properly center fixtures in each room. Where multiple fixtures occur, space them uniformly and in straight lines with each other.
- B. Where lighting fixtures are shown to conflict with locations of structural members and mechanical or other equipment, provide adequate supports and wiring to clear same.

3.2 SUPPORTS

- A. Provide all necessary connectors, straps, etc., for secure mounting of all fixtures.
- B. Support surface mounted fluorescent fixtures installed on gypsum board or concrete ceilings from the ceiling with proper anchors at each corner of the fixture.

3.3 LAMP BURN-IN

- A. Burn-in all fluorescent lamps for a minimum of 100 hours prior to completion of the project and replace all defective lamps.

3.4 COORDINATION

- A. Coordinate ceiling types with General Contractor and verify compatibility with fixture mounting provisions prior to ordering fixtures. Immediately notify the Architect in writing of any discrepancies between ceiling types and specified fixture types.
- B. Verify available voltages and coordinate fixture voltage with the fixture supplier prior to ordering fixtures. Immediately notify the Architect in writing of any discrepancies between available voltages and the specified fixture voltages.
- C. Coordinate fixture locations with other contractors to provide adequate clearance between fixtures and ductwork, piping, structural members, etc., for proper installation of fixtures and provide access for maintenance or replacement of the fixtures.

* END OF SECTION 16500 *

SECTION 16720 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. The existing building is protected by a complete fire alarm system. Modify and extend the existing fire alarm system as required to coordination with new construction and remodeling.
- B. Provide new initiating devices, notification appliances and other accessories as shown on drawings and as required.

1.3 SUBMITTALS

- A. Provide submittals for the Fire Alarm System in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.
- B. Provide manufacturer's standard catalog literature for all new Fire Alarm System Devices.
- C. Provide battery calculations, voltage drop calculations, and additional submittals documents required by IFC 907.1.1 and as applicable to the project.
- D. Provide two copies of the Fire Alarm System Shop Drawing Submittals, in addition to the quantity of submittals required by the Division 1 Specification Sections, for review by the local Authority Having Jurisdiction (AHJ).
 - 1. Approval of the AHJ is required prior to installing any part of the Fire Alarm System.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- A. Existing ADT Unimode main fire alarm control panel is to remain.
 - 1. Provide new zone modules, control relays, etc., as required to control new fire alarm system initiating devices, notification appliances and control devices.
 - 2. Modify the main fire alarm control programming to properly annunciate and control new fire alarm system devices.
- B. Provide additional power supplies and/or batteries as required to operate the system with additional smoke detectors, notification appliances, fan shut down relays, etc..

- C. Identify each new zone by specific location with neatly typed labels on the control panel.

2.2 DUCT SMOKE DETECTOR

- A. Provide new duct mounted photoelectric smoke detectors with cabinet mounted alarm LED and duct sampling tubes where indicated on the drawings.
- B. Provide sampling tubes to extend the full width of the ducts.

2.3 NOTIFICATION APPLIANCES

- A. Provide new Notification Appliances which meet the requirements of National Fire Alarm Code - NFPA 72, ANSI 117.1, UL Standard 1971 and ADA-AG 4.28
- B. Provide new Wheelock NSS-24-MCW, or equal, combination Horn/Strobe with flush mounting backbox and red finish where indicated on drawings.
- C. Provide new Horns to produce minimum 86 dB at 10 feet. Provide new horns to match sound of existing horns in the building.
- D. Provide new flashing strobe lights with lexan lens with the word "FIRE" in red letters and minimum effective candle power ratings as indicated on drawings and a flash rate of between one and two flashes per second.

2.4 FIRE SAFETY FUNCTION CONTROL RELAYS

- A. Provide new control relays with SPDT contacts rated 10 amps at 120 VAC and with 24 VDC coil to control fan shut down, smoke dampers, etc., as shown on the drawings.
- B. Provide fan shut down control relays in separate enclosure adjacent to the starter enclosure, or within the enclosure, of each air supply fan as shown on drawings and connect to a normally closed auxiliary contact in the fire alarm control panel. Connect the fan control circuit to the control relay output contacts so that the air supply fan will shut down upon general fire alarm.

2.5 WIRING

- A. Furnish and install new copper wire for all fire alarm system wiring of the sizes indicated on the drawings. Install all wiring in approved metal raceway system as specified for power wiring except that minimum 1/2" trade diameter conduit may be used.
- B. Wire for Initiating Device Circuits shall be minimum #14 AWG, Type THHN/THWN.
- C. Wire for Notification Appliance Circuits shall be minimum #12 AWG, Type THHN/THWN.
- D. Wire for Fire Safety Function Circuits shall be minimum #14 AWG, Type THHN/THWN.
- E. Do not install fire alarm system wiring in raceways with any other wiring systems.

2.6 SYSTEM OPERATION

- A. The existing fire alarm system operation is as follows: Activation of any initiating device will cause all notification appliances to operate, shut down all air handling fans, and transmit alarm signal to the central fire station. Alarm signals may be reset or silenced by authorized personnel only by entering a locked control cabinet and operating the proper silencing switch.
- B. Wire and program all new fire alarm system devices to be compatible with the existing system operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all raceways for signaling line circuits and notification appliance circuits with separate raceways entering and leaving each outlet box and/or enclosure.
 - 1. Wire the fire alarm system initiating device circuits in a Class A loop in accordance with NFPA 72-2007.
 - 2. Wire the fire alarm system notification appliance circuits in a Class A loop in accordance with NFPA 72-2007.
- B. Color code fire alarm system wiring as recommended by the manufacturer to match the existing fire alarm system color coding. Tag all conductors according to zone circuit at all terminals, pull and junction boxes.
- C. Paint all fire alarm system junction boxes, pull boxes, etc. red with identification of zones served indicated on the device or box.
- D. Supervision of installation, final connections, programming and testing will be provided by a trained factory representative of the existing fire alarm system manufacturer.
 - 1. Contact: ADT Security Systems
536 East 300 South
Salt Lake City, Utah 84102
(801) 799-5625

3.2 SYSTEM OUTAGES

- A. The existing Fire Alarm System will remain completely operational throughout construction except portions may be temporarily taken out of service for reconnections as indicated on the drawings.
 - 1. Submit requests for fire alarm system outages to the Owner's Project Manager not less than 7 day prior to any proposed fire alarm outages.
 - 2. Immediately notify the Owner's Project Manager if the fire alarm is unintentionally disabled and immediately make repairs to restore the system to an operational condition.
 - 3. The contractor shall maintain a fire watch during all fire alarm system outages in accordance

with IFC Section 901.7.

4. Do not leave any portion of the fire alarm system inoperable longer than is absolutely necessary make reconnections.
5. Provide temporary wiring and/or connections as required to maintain the system in an operable condition.

3.3 RECORD DRAWINGS

- A. Provide new building map for the existing control panel to reflect floor plan changes, and new initiating devices locations. Mount the building map behind a protective plastic covering.
- B. Provide new fire alarm system record drawings to include locations and wiring of new and existing devices and equipment as installed. Include junction box locations and device wiring.

3.4 TESTS

- A. Prior to Substantial Completion conduct a complete system test to show that all new and existing equipment is in proper working order. Schedule the test at a time acceptable to all parties involved.
 1. Tests shall be conducted in the presence of the Authority Having Jurisdiction, Owner and Architect and/or Engineer.
- B. Provide two-way radios, canned smoke and a hair dryer (or other means to set off smoke and heat detectors).
- C. Put the main control panel on battery power not less than 24 Hours prior to testing. The batteries shall maintain the fire alarm system in supervisory mode for not less 24 Hours and then be able to operate all notification appliances continuously for not less than 5 Minutes.
- D. All devices will be complete and operational.

3.5 TRAINING

- A. In addition to any detailed instructions called for, the Contractor must provide, without additional expense to the Owner, competent instruction to train owner's personnel who will be in charge of the system, in the care and operation of the modified portions of the system. Instruction date will be set at time of final inspection.

* END OF SECTION 16720 *