STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

January 29, 2007

ACTIVITY CENTER HVAC UPGRADE AND STORAGE ADDITION

SNOW COLLEGE
EPHRAIM, UTAH

DFCM Project Number 05266700

Gould Evans and Associates
1000 South Main, Suite 1
Salt Lake City, Utah 84101

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Fairpark Map

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:

ACTIVITY CENTER HVAC UPGRADE AND STORAGE ADDITION
SNOW COLLEGE – EPHRAIM, UTAH
DFCM PROJECT NO: 05266700

Bids will be in accordance with the Contract Documents that will be available at 12:00 NOON on Monday, January 29, 2007 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 Kurt Baxter, DFCM, at 801-538-3174. No others are to be contacted regarding this bidding process. The construction budget for this project is $860,408.

A **mandatory** pre-bid meeting will be held at 10:00 AM on Friday, February 9, 2007 at the Snow College Activity Center, 150 College Ave., Ephraim, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 1:00 PM on Wednesday, February 21, 2007 at the Wasatch Building at the Utah State Fairpark, approximately 155 North 1000 West, Salt Lake City, Utah. Refer to the map on the DFCM website for directions (http://dfcm.utah.gov/downloads/fairpark_map.pdf). Bids will be opened and read aloud in the Wasatch Building at the Utah State Fairpark. NOTE: Bids must be received at the Wasatch Building at the Utah State Fairpark 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
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION

The Project consists of adding new space and minor remodel of existing space and HVAC upgrades. Construct a 4400 SF dance room addition on the north side of the Snow College Activities Center. New space includes a dance room, conference room, hallway, unisex restroom, and storage room.

PROJECT SCHEDULE

PROJECT NAME: **ACTIVITY CENTER HVAC UPGRADE AND STORAGE ADDITION SNOW COLLEGE – EPHRAIM, UTAH**

DFCM PROJECT #: **05266700**

Event	Day	Date	Time	Place
Bidding Documents Available	Monday	January 29, 2007	12:00 NOON	DFCM 4110 State Office Bldg SLC, UT or DFCM web site *
Mandatory Pre-bid Site Meeting	Friday	February 9, 2007	10:00 AM	Snow College Activity Center 150 College Ave. Ephraim, UT
Last Day to Submit Questions	Tuesday	February 13, 2007	4:00 PM	Kurt Baxter – DFCM e-mail kbaxter@utah.gov
Addendum Issued Responding to Questions (if needed)	Friday	February 16, 2007	4:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Wednesday	February 21, 2007	1:00 PM	Wasatch Building Utah State Fairpark Approx 155 North 1000 West Salt Lake City, UT **
Sub-contractor List Due	Thursday	February 22, 2007	1:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Monday	August 20, 2007	5:00 PM	

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

** **Due to the ongoing construction on Capitol Hill and the anticipated shortage of parking during 2007, all bids will be received and opened at the Wasatch Building at the Utah State Fairpark. Refer to map on the DFCM web site for directions (http://dfcm.utah.gov/downloads/fairpark_map.pdf)**

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 **ACTIVITY CENTER HVAC UPGRADE AND STORAGE ADDITION - SNOW COLLEGE – EPHRAIM, UTAH - DFCM PROJECT #:05266700** 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: _____

BASE BID: 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)

ADDITIVE ALTERNATE #1: To install custom designed Architectural windows as per the Specifications and Contract Documents, I/we agree to perform for the sum of:

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

I/We guarantee that the Work will be Substantially Complete by **August 20, 2007** should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$400.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

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

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

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

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

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

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

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

2. Bids

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

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

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

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

3. Contract and Bond

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

4. Listing of Subcontractors

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

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

5. Interpretation of Drawings and Specifications

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

6. Addenda

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

7. Award of Contract

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

8. DFCM Contractor Performance Rating

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

9. Licensure

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

10. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

11. Time is of the Essence

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

12. Withdrawal of Bids

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

13. Product Approvals

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

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

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

15. Debarment

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

BID BOND

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

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

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

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

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

DATED this _____ day of _____, 20_____ .

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

_____

_____

By:_____

Title: _____

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

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

_____
NOTARY PUBLIC

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

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

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

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

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

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

LICENSURE:

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

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

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

'SPECIAL EXCEPTION':

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

GROUNDS FOR DISQUALIFICATION:

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

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

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

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

EXAMPLE:

Example of a list where there are only four subcontractors:

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

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

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and

DFCM

SUBCONTRACTORS LIST

FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

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

We certify that:

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

FIRM: _____

DATE: _____ SIGNED BY: _____

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

FUGITIVE DUST PLAN

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

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

Utah Division of Air Quality
April 20, 1999

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

Source Information:

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

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

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

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

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

6. Type of material processed or disturbed.

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

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

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

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

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

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

2. List type of equipment generating the fugitive dust.

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

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

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

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

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

Description of Fugitive Dust Emission Controls on Site

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

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

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

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

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

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

Description of Fugitive Dust Control Off-site

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

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

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

Submit the Dust Control Plan to:

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

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

Fugitive Dust Control Plan Violation Report

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

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

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

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

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

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

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

Submit the Dust Control Plan to:

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

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

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

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONTRACTOR: _____

_____
Signature Date

Title: _____

State of _____)
)
County of _____)

_____
Please type/print name clearly

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

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

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

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____- Manager Date
Capital Development/Improvements

APPROVED AS TO FORM:
ATTORNEY GENERAL
November 30, 2006
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

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

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

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

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

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

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

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

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

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____

Agent: _____

Address: _____

Phone: _____

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

DFCM FORM 1b 113006

PAYMENT BOND

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

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

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

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

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

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

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

My commission expires: _____
Resides at: _____

_____
NOTARY PUBLIC

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

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

DFCM FORM 1b 113006

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

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

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

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

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

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

Page _____ of _____page(s)

DFCM FORM 1b 113006

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____
AGENCY/INSTITUTION _____

AREA ACCEPTED _____

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

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

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

_____

_____

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

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

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

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

_____ by: _____
CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____
A/E (include name of firm) (Signature) DATE

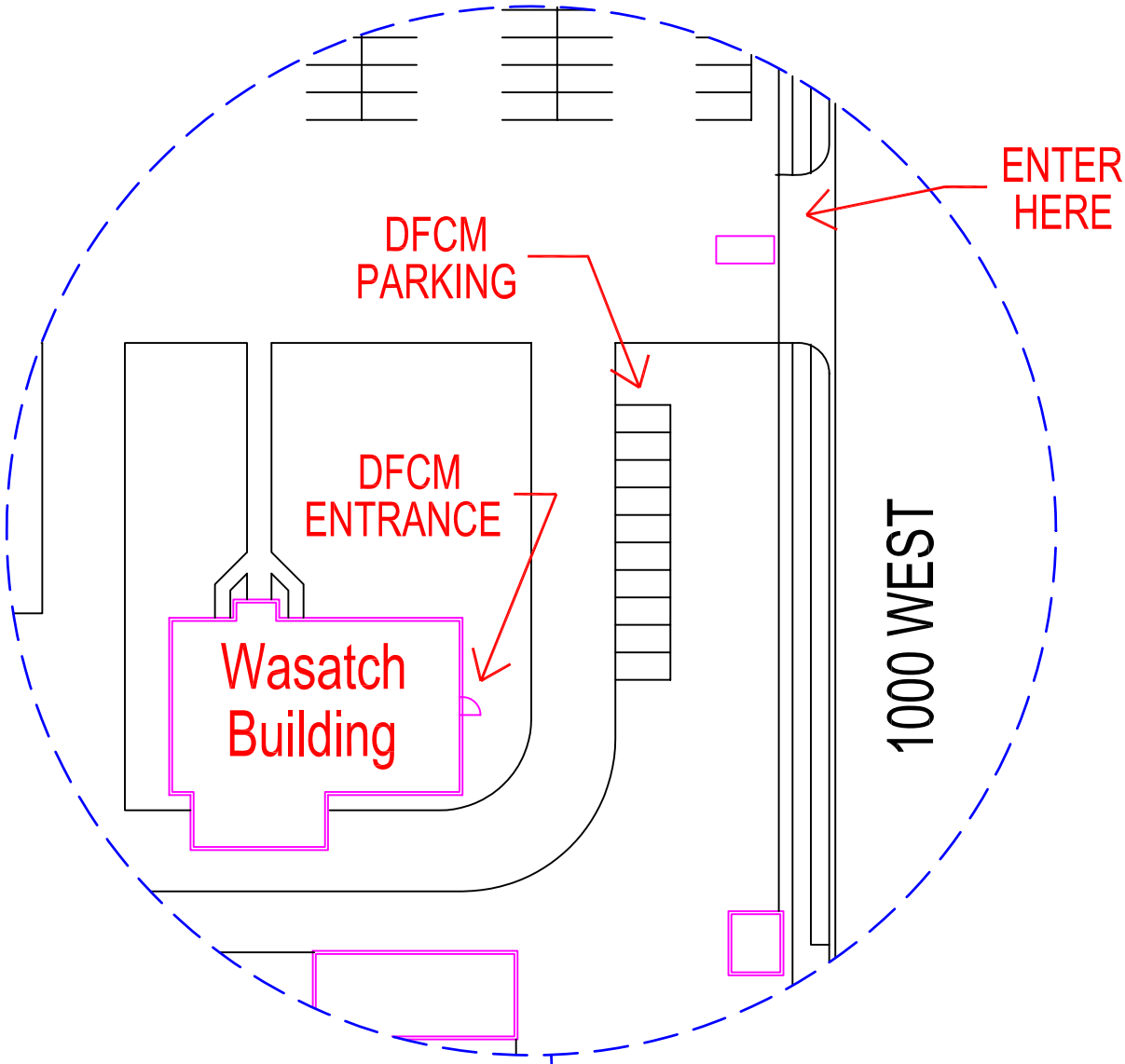
_____ by: _____
USING INSTITUTION OR AGENCY (Signature) DATE

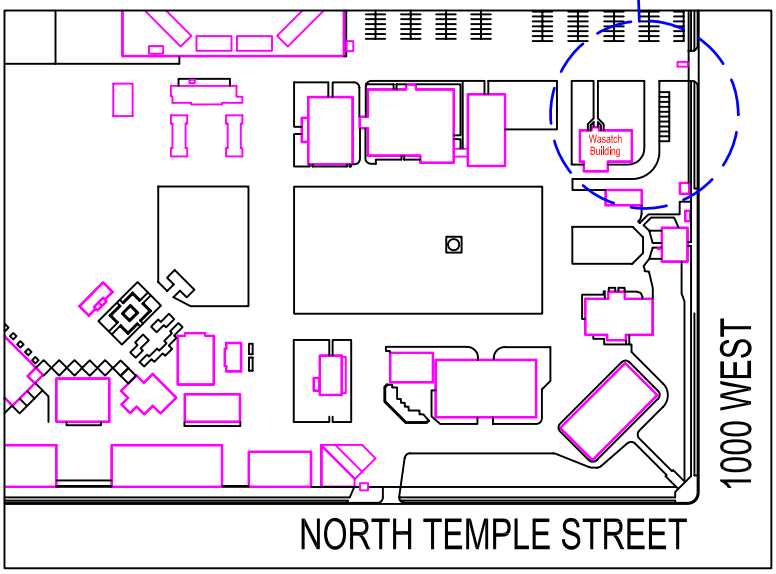
_____ by: _____
DFCM (Owner) (Signature) DATE

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

cc: Parties Noted
DFCM, Director

DFCM FORM 1b 113006





UTAH STATE
FAIR PARK

N

DFCM Temporary Location

Project Manual and Specifications for:

Snow College
Activities Center
Dance Studio Addition/Remodel

Ephraim, Utah

Construction Drawings Set

05 January, 2007

DFCM Project No. 05266700
GEA Project Number: 0906.0260

Prepared by:

GouldEvans
1000 South Main Street, Suite 100
Salt Lake City, Utah 84101-3115

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Bid Form

00.09.01

Sub-Contractor Contract

PROJECT IDENTIFICATION: Snow College Activity Center Dance Studio Addition/Remodel
Ephraim, UT

BID TO:

BID FROM: _____

_____

_____

_____

1. The undersigned BIDDER agrees, if this Bid is accepted, to enter into an agreement with GENERAL CONTRACTOR, in the form included in the Bidding documents, to perform and furnish the Work as specified or indicated in the Bidding Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
2. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement that;
   a. This Bid will remain subject to acceptance for 30 days after the scheduled closing time for receipt of bids;
   b. Both the Owner and the Contractor have the right to reject this Bid;
   c. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within 14 days after notification of selection for the award of a Contract for the Work;
   d. BIDDER has examined copies of all the Bidding Documents;
   e. BIDDER has visited the site and become familiar with the general, local, and site conditions;
   f. BIDDER is familiar with federal, state, and local laws and regulations;
   g. BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Bidding Documents and additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
   h. This Bid is genuine and not made in the interest of or on behalf of an undisclosed person, firm, or corporation and is not submitted in conformity with an agreement or rules of a group, association, organization, or corporation; BIDDER has not directly or indirectly induced or solicited another Bidder to submit a false or sham Bid; BIDDER has not solicited or induced a person, firm, or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself an advantage over another BIDDER or over OWNER;
   i. BIDDER has received the following Addenda receipt of which is hereby acknowledged;

Number	Date	Number	Date

3. BIDDER will complete the Work in accordance with the Contract Documents for the following price(s):

STIPULATED-SUM BID PRICE

_____ dollars
(words)

($_____)
(numbers)

UNIT PRICES

If the required quantities are known, they are listed below. If the required quantities of the items listed below are increased or decreased by Change Order, the adjustment unit prices set forth below shall apply to such increased or decreased quantities.

No.	Item	Quantity	Unit	Unit Price
1.	Site Excavation	*unknown*	Cubic yard	$_____
2.	Engineered Fill	*unknown*	Cubic yard	$_____
3.	Re-compacted Soil	*unknown*	Cubic yard	$_____

4. BIDDER agrees to supply Owner / General Contractor with bond, insurance, proof of licensure, etc. if required by either the Owner or the General Contractor. BIDDER agrees to supply Owner / General Contractor with lien waivers as required by General Contractor / Sub-contractor Agreement or upon request from either the Owner or General Contractor

SUBMITTED on _____
(month) (day) (year)

Bidder: _____
(firm / corporation / company name)

Name: _____
(printed name of person authorized to sign)

By: _____
(signature of person authorized to sign)

Title: _____
(title of person authorized to sign)

Business Address _____

_____

_____

_____

Phone Number: _____

State of Incorporation: _____

(if applicable)

amec

REPORT
GEOTECHNICAL STUDY
ADDITIONS TO EXISTING ACTIVITIES CENTER
SNOW COLLEGE ACTIVITIES CENTER FACILITY
EPHRAIM, UTAH

Submitted To:

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

Submitted By:

AMEC Earth & Environmental, Inc.
Salt Lake City, Utah

February 16, 2004

Job No. 4-817-004694

February 16, 2004
Job No. 4-817-004694

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

Attention: Mr. David McKay

Gentlemen:

Re: Report
Geotechnical Study
Additions to Existing Activities Center
Snow College Activities Center Facility
Ephraim, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed additions to the existing Snow College Activities Center located at 300 East Center Street in Ephraim, Utah. The location of the site with respect to major topographic features, adjacent roads, and other facilities, as of 1966, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing proposed additions with respect to existing structures and roads is presented on Figure 2, Site Plan. The locations of the four borings drilled in conjunction with this study are also presented on Figure 2.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of this study were planned in discussions between Mr. David McKay of the State of Utah Division of Facilities Construction and Management; Mr. Mark Harris of Reaveley Engineer & Associates, structural engineer; Mr. Kevin Blaylock of Gould Evans Associates, L.C., architect; and Mr. Bill Gordon of AMEC Earth & Environmental, Inc. (AMEC).

AMEC Earth & Environmental, Inc.
4137 South 500 West
Salt Lake City, Utah 84123
Tel: +1 (801) 266-0720
Fax: +1 (801) 266-0727 www.amec.com

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate foundation and earthwork recommendations to be utilized in the final design and construction of the proposed facilities.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of 4 exploration borings extending to depths of between 15.5 and 26.5 feet below existing grade.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by issuing Purchase Order No. 21706 dated January 22, 2004.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, AMEC must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices at this time.

2. PROPOSED CONSTRUCTION

The additions to the northeast and northwest sides of existing Activities Center will consist of classrooms, a conference room, and dance and fitness rooms. The northwestern addition will have maximum plan dimensions of about 185 feet in the east-west direction and about 60 feet in the north-south direction. The northeastern addition will have maximum plan dimensions of about 120 feet in the east-west direction and about 66 feet in the north-south direction.

The additions will be one to one-extended level in height and of light steel/wood-frame and masonry construction. Floor slabs will match the slabs of the existing building. Structural loads will be transmitted down through columns and bearing walls to the supporting foundations. We project the maximum column and wall loads will be on the order of 50 to 150 kips and 3 to 6 kips per lineal foot, respectively. Loads associated with the additions are not anticipated to be imposed upon footings associated with the existing building to the south.

Site grading will require structural fills of three to four feet to match existing floor slabs.

3. INVESTIGATIONS

3.1 SUBSURFACE EXPLORATION

In order to define and evaluate the subsurface conditions, 4 exploration borings extending to depths ranging from 15.5 to 26.5 feet were drilled with a rubber tire-mounted all-terrain-type rotary drill rig equipped with hollow-stem augers. The locations of the borings are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, relatively undisturbed samples of the typical soils penetrated were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications were later supplemented by subsequent inspection and testing in our laboratory. A detailed graphical representation of the subsurface conditions encountered is presented on Figures 3A through 3D, Log of Borings. Soils were classified in accordance with the nomenclature described on Figure 4, Unified Soil Classification System.

3.2 LABORATORY TESTING

3.2.1 General

A laboratory testing program was conducted to provide data for our engineering analyses. The program included moisture, density, pH and soluble sulfates, and collapse-consolidation tests. The following sections describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of the moisture and density tests are presented on the boring logs, Figures 3A through 3D.

3.2.3 pH and Soluble Sulfates Tests

To determine if the site soils will react detrimentally with concrete, pH and soluble sulfates tests were performed on a representative sample of the native near-surface soils. The results of those tests are presented below:

Boring No.	Depth (feet)	USCS Group Symbol	pH	Water Soluble Sulfate (percent)
B-1	2.5	CL/ML	7.4	<0.0010

3.2.4 Collapse-Consolidation Tests

To determine the collapse potential of the site soils and to provide data necessary for settlement analysis, a collapse-consolidation test was performed on each of five representative samples. The collapse portion of the tests were performed in accordance with the following procedure:

1. Load sample at in-situ moisture content to specific axial pressure.
2. Measure and record axial deflection.
3. Saturate sample.
4. Measure and record resulting collapse.

The results of the collapse test are tabulated below:

Boring No.	Depth (feet)	Soil Type	Natural Dry Density (pcf)	Natural Moisture Content (percent)	Axial Load When Saturated (psf)	Collapse (-) or Swell (+) (percent)
B-1	4.5	CL/ML	89.2	15.3	1,600	3.7 (-)
B-2	10.0	CL	102.8	19.9	1,600	0.7 (-)
B-2	20.5	CL	112.1	17.3	1,600	0.0 (-)
B-4	5.5	SM/ML	99.7	16.1	1,600	0.6 (-)
B-4	15.5	CL/ML	107.0	11.2	1,600	0.7 (-)

A significant portion of measured collapse less than about 1 percent is normally attributable to sample disturbance and not collapse potential. The results of the collapse tests indicate that the near-surface silty clay/clayey silt soil in Boring B-1 at 4.5 feet is slightly to moderately

collapsible. This soil also exhibited a "pinhole"-type structure and has a low dry density. Both are also characteristics of collapsible soils. Deeper fine-grained clays, silts, and sands are not considered collapsible.

Following the collapse tests, the samples were subjected to normal consolidation loading. The sample from Boring B-1, which exhibited significant collapse, became highly compressible upon saturation. The other soils did not exhibit this condition, but exhibited only moderate over-consolidation. Detailed results of our tests are maintained within our files and can be provided, upon your request.

4. SITE CONDITIONS

4.1 SURFACE

The site of the proposed additions is a grass landscaped area, on the northern side of the existing Activities Center, with maximum plan dimensions of 65 feet in the north-south direction and 410 feet in the east-west direction. Shrubs are presented in areas around the immediate perimeter line of the existing building and a few large trees are found around the perimeter of the site. The site is bound on the north by Center Street roadway, and to the east and west by parking areas.

The existing building is of masonry construction and composed of one-level office and classroom areas and one-extended level to two level gymnasium and swimming pool areas. The existing structure is, except for the gymnasium and pool area, constructed over an approximately five-foot crawl space which in the western portion of the site connects with a steam utility tunnel. No settlement distress was observed in the building. Some of the sidewalks crossing the site appear to have settled up to two inches and have been replaced in places.

The surface of the site slopes down to the northwest with overall relief on the order of six feet.

4.2 SUBSURFACE SOIL CONDITIONS

The soils encountered at each of the boring locations were generally similar.

Non-engineered fill soils composed of silty clay/clayey silts with varying amounts of fine to coarse sands and fine and coarse gravels were encountered at the ground surface in Borings B-1, B-3, and B-4 to depths of 3.0, 4.5, and 2.0 feet below existing grade, respectively. Major roots (topsoil) were encountered in the upper two to three inches in each of the borings. Non-engineered fills and topsoil will exhibit generally poor engineering characteristics.

Underlying the fills in Borings B-1 and B-4, brown silty clay/clayey silts with trace to some fine sand were found extending to 25.5 feet, the depth explored in Boring B-1, in both borings. At the ground surface in Boring B-2 and below the fills in Boring B-3, the natural soils consist of brown fine sandy clays extending to 26.0 and 13.0 feet below existing grade, respectively. The

silts and clays in each of the borings contained occasional to numerous 1.0 to 3.0 inches thick sand to silty sand layers. A layer to 2.5 feet thick of silty sands, some with gravels, were encountered at depths of 21.0 and 5.0 feet in Borings B-2 and B-4, and from 13.0 feet to the depth explored of 15.5 in Boring B-3.

Some of fine-grained soils sampled exhibit a "pinhole"-type structure which is often indicative of a moisture sensitive soil. Laboratory data have indicates that only the sample of silty clay/clayey silt at 4.5 feet in Boring B-1 exhibits significant collapse characteristics. The collapse potential in soils tested at similar and deeper depths in other borings is considered negligible. The fine-grained soils are slightly moist to moist, medium stiff to stiff, and, where not collapsible, will exhibit moderate strength and compressibility within the anticipated loading range.

Below the clays in Borings B-2 and B-4, dense brown sands and gravels extend to the depths explored of 26.5 in each boring.

Groundwater was not encountered in any of the borings during the course of our field investigation and is not expected to affect the site as proposed.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 DISCUSSIONS OF FINDINGS

The geotechnical aspects of the site that will most influence the design and construction of the proposed additions are:

1. Surficial non-engineered fills.

2. Moisture sensitive (collapsible) soils which were encountered in Boring B-1 to a depth of approximately five feet.

Collapsible soil zones may extend deeper and at other locations. Collapse-related settlements could be as high as one to two inches.

To control settlements, it is our recommendation that all non-engineered fills be removed from an area extending out at least five feet from the perimeter of the proposed additions. In addition, soils containing an abundant "pinhole" structure (collapsible) should be removed from beneath proposed footings. It is projected that these soils could extend to depths of five to six feet in areas. Collapse soils may generally remain below the at-grade slabs.

The collapsible soils and non-engineered fills can be re-utilized as structural site grading fill if they meet the structural fill requirements, but will require close moisture control during placement and compaction.

The proposed additions may be supported upon conventional spread and continuous wall foundations supported upon suitable non-collapsible natural soils and/or structural fill extending to suitable natural soils.

Detailed discussions pertaining to earthwork, foundations, floor slabs, lateral resistance, and the geoseismic setting of the site are discussed in the following sections.

5.2 EARTHWORK

5.2.1 Site Preparation

Preparation of the site will consist of the removal of all surface vegetation, topsoil, concrete slabs, non-engineered fills, and other deleterious materials from beneath an area extending out at least five feet from the perimeter of the proposed additions. Debris and vegetation should be removed from the site. Topsoil, although unsuitable for utilization as structural fill, may be stockpiled for landscaping purposes. Subsequently, collapsible soil must also be removed from beneath the proposed foundation. If is projected that the potentially collapsible soils could extend to depths of five to six feet in area.

Subsequent to the above operations and prior to the placement of structural site grading fill, or floor slabs, the exposed natural subgrade must be proofrolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If any loose, soft, or disturbed zones are encountered, they must be completely removed in footing and floor slab areas and replaced with granular structural fill.

5.2.2 Excavations

Temporary construction excavations not exceeding four feet in depth may be constructed with near-vertical sideslopes. Deeper excavations to depths of up to ten feet in cohesive soils should be constructed with sideslopes no steeper than one-half horizontal to one vertical. If excessive sloughing occurs, or if extensive layers of clean granular soils are encountered, the sideslopes must be flattened.

All excavations must be observed periodically by qualified geotechnical personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill will be required as backfill over foundations and utilities, as site grading fill, and possibly as replacement fill below footings. All structural fill must be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials.

Structural site grading fill is defined as fill placed over fairly large open areas to raise the overall site grade. The maximum particle size within structural site grading fill should generally not

exceed four inches; although, occasional particles up to six to eight inches may be incorporated provided that they do not result in "honeycombing" or preclude the obtainment of the desired degree of compaction. In confined areas, such as footing and utility excavations, the maximum particle size should generally be restricted to two inches. So that the compacted fill is essentially impermeable, we recommend that granular sols be well-graded and contain at least 25 percent fines. Plasticity index of the fine-grained soils should not exceed 18 percent.

On-site fine-grained and granular soils may be re-utilized as structural site grading fill if they do not contain significant amounts of deleterious material. The fine-grained soils will require that very close moisture control be maintained during placement and compaction. It will be very difficult, if not impossible, to properly place and compact these fills during wet and cold periods of the year. Only granular soils, such as well-graded mixtures of sands and gravels with at least 25 percent fines, should be used in confined areas.

5.2.4 Fill Placement and Compaction

All structural fill should be placed in lifts not exceeding eight inches in loose thickness. Fills up to 10 feet thick, and/or beneath all footings and floor slabs, should be compacted to at least 95 percent of the maximum dry density as determined by the AASHTO[1] T-180 (ASTM[2] D-1557) compaction criteria. Fills greater than 10 feet thick are not anticipated at the site. All other structural fill should be compacted to at least 90 percent of the above-defined criteria.

Prior to the placement of structural site grading fill, the exposed subgrade must be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation must consist of the removal of all loose or disturbed soils.

5.3 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.3.1 Design Data

The results of our analyses indicate that the proposed additions may be supported upon conventional spread and/or continuous wall foundations established upon suitable non-collapsible natural soils and/or structural fill extending to suitable natural soil. For design, the following parameters are recommended:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches

1 American Association of State Highway and Transportation Officials
2 American Society for Testing and Materials

Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Pressure for Real Load Conditions	- 2,000 pounds per square foot*
Bearing Pressure Increase for Seismic Loading	- 50 percent

* By placing replacement granular fill beneath footings higher bearing pressures can be utilized.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.3.2 Installation

Under no circumstances should the footings be established upon loose or disturbed soils, sod, rubbish, construction debris, non-engineered fill, collapsible soils, other deleterious materials, frozen soils, or within ponded water. If unsuitable soils are encountered, they must be removed and replaced with compacted structural fill. If soils become loose or disturbed, they must be recompacted to the requirements for structural fill.

The width of structural replacement fill below footings should be equal to the width of the footing plus one foot for each foot of fill thickness.

5.3.3 Settlements

Settlement of foundations designed and installed in accordance with the above recommendations, and supporting maximum loads as discussed in Section 2., Proposed Construction, should not exceed one-half of an inch. Approximately 50 to 60 percent of the quoted total settlements should occur during construction.

5.4 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the

supporting soils. In determining frictional resistance, a coefficient of 0.40 should be utilized for footings established upon natural fine-grained soils. For footings established on granular structural fill, a coefficient of up to 0.45 may be used. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, if encountered, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.5 FLOOR SLABS

Under no circumstances should floor slabs be established over non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. The projected collapse potential of defined near-surface collapsible soils under floor slab loading is projected to be on the order of 1 percent. Therefore, if three to four feet of collapsible soils were present the settlement potential would be on the order of three-eighths of an inch. Generally this magnitude of settlement can be tolerated.

We recommend that "free-draining" granular material <u>not</u> be placed beneath floor slabs as it would facilitate the entrance of water into the underlying soils.

5.6 CEMENT TYPE

The chemical test results indicate that the natural site soils contain a negligible percentage of water soluble sulfates. Based upon this data, sulfate resistant cement will not be required for concrete in contact with the site soils.

5.7 GEOSEISMIC SETTING

5.7.1 General

In early 2002, Utah adopted the International Building Code (IBC) 2000. The IBC 2000 code determines the seismic hazard for a site based upon regional mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class (formerly soil profile type). The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points). In comparison, the former UBC (Uniform Building Code) generally placed the entire Wasatch front into a single seismic zone (Seismic Zone 3).

The structure must be designed in accordance with the procedure presented in Chapter 16 of the IBC 2000 edition.

5.7.2 Site Class

For dynamic structural analysis, the Site Class "D" as defined in Table 1615.1.1, Site Class Definitions of the 2000 IBC, can be utilized.

5.7.3 Ground Motion

The USGS, through the National Earthquake Hazards Reduction Program (NEHRP, 1997), has evaluated and mapped the general seismic characteristics of the conterminous United States, particularly the western United States. The NEHRP ground motion data are probabilistic peak horizontal ground accelerations associated with points mapped on a grid system. The ground motion data for a site can be determined based on the latitude and longitude coordinates of the site. The acceleration values apply to the dense soil to rock boundary between Site Classes "B" and "C" (Site Class B-C Boundary), as defined by NEHRP 1997.

The coordinates of the site are 39.359 degrees north latitude and 111.577 degrees west (negative) longitude. The ground motion values for the USGS grid point closest to the site location are summarized in the table on the following page. The ground motion values in the table incorporate soil amplification factors for a Site Class "D" soil profile.

Acceleration Criteria	Probabilistic Peak Horizontal Ground Accelerations (percent g) Mapped USGS Values With Soil Amplification 2% in 50 yr Event (2475-yr return period)
PGA* (g)	0.328
0.2 sec SA** (g)	0.819
1.0 sec SA** (g)	0.403

* PGA - Peak Ground Acceleration (horizontal)

** SA - Spectral Acceleration (for response spectrum)

IBC 2000 designs are based upon two-third of the volume presented above for the 2 percent in 50-year event.

5.7.4 Faulting

No active faults are mapped across or immediately adjacent to the site. The nearest potentially active fault is the Gunnison fault located about five miles west of the site.

5.7.5 Liquefaction

In general terms, liquefaction is defined as the condition when saturated, loose, fine sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event.

Soils encountered in the borings, to the depth explored of 26.5 feet, are unsaturated and are not considered susceptible to liquefaction.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Matthew C. Gallegos
Staff Geotechnical Engineer

Reviewed by:

William J. Gordon, State of Utah No. 146417
Professional Engineer

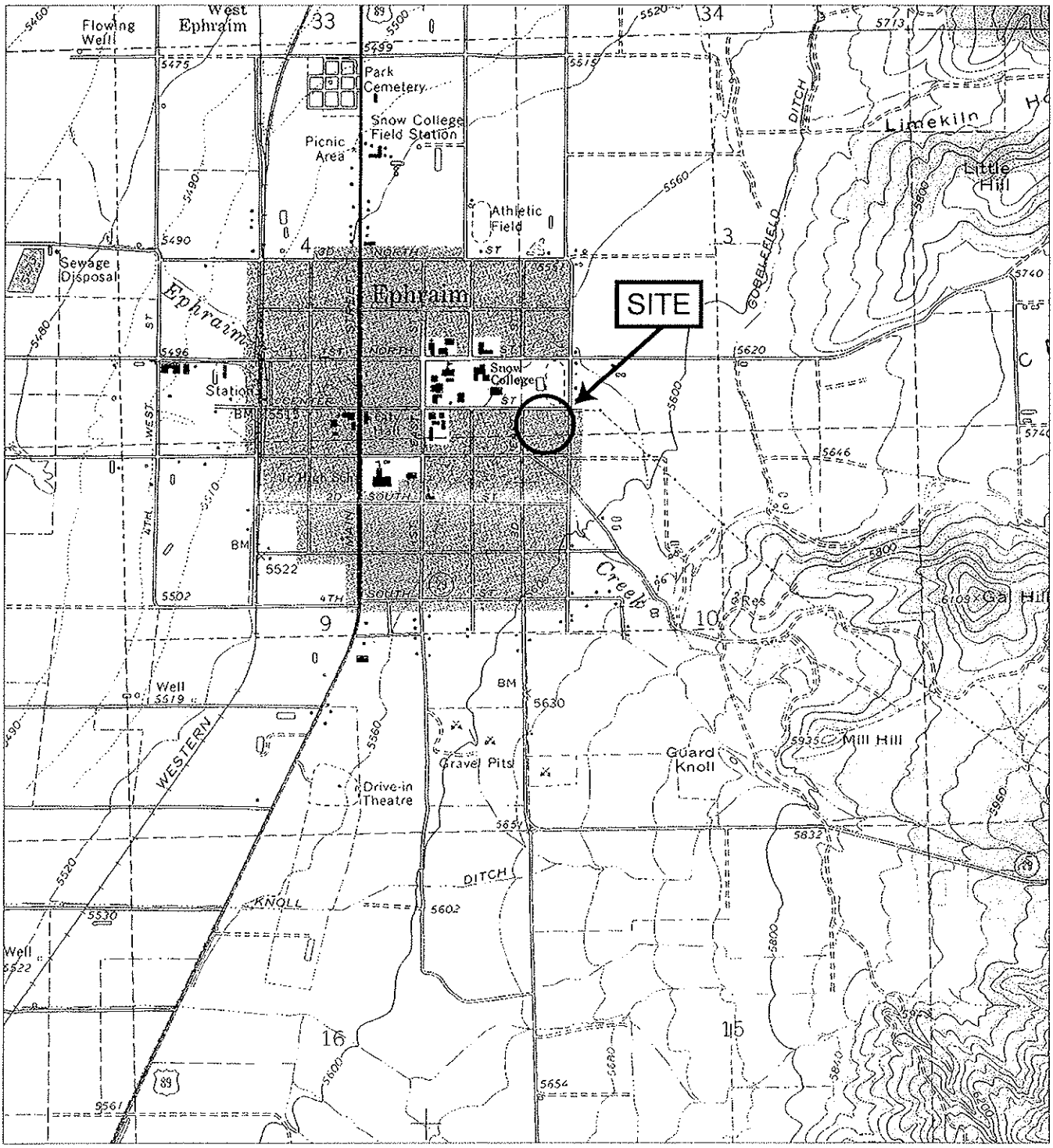
MCG/WJG:sn

Encl. Figure 1, Vicinity Map
Figure 2, Site Plan
Figures 3A through 3D, Log of Borings
Figure 4, Unified Soil Classification System

Addressee (3)
c: Mr. Mark Harris (1)
Reaveley Engineers & Associates
1515 South 1100 East
Salt Lake City, Utah 84115-2424

Mr. Kevin Blaylock (1)
Gould Evans Associates, L.C.
1000 South Main Street, Suite 100
Salt Lake City, Utah 84101

STATE OF UTAH - DFCM
JOB NO. 4-817-004694



SCALE IN FEET

1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "EMPHRAIM, UTAH"
DATED 1966

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STATE OF UTAH – DFCM
JOB NO. 4-817-004694

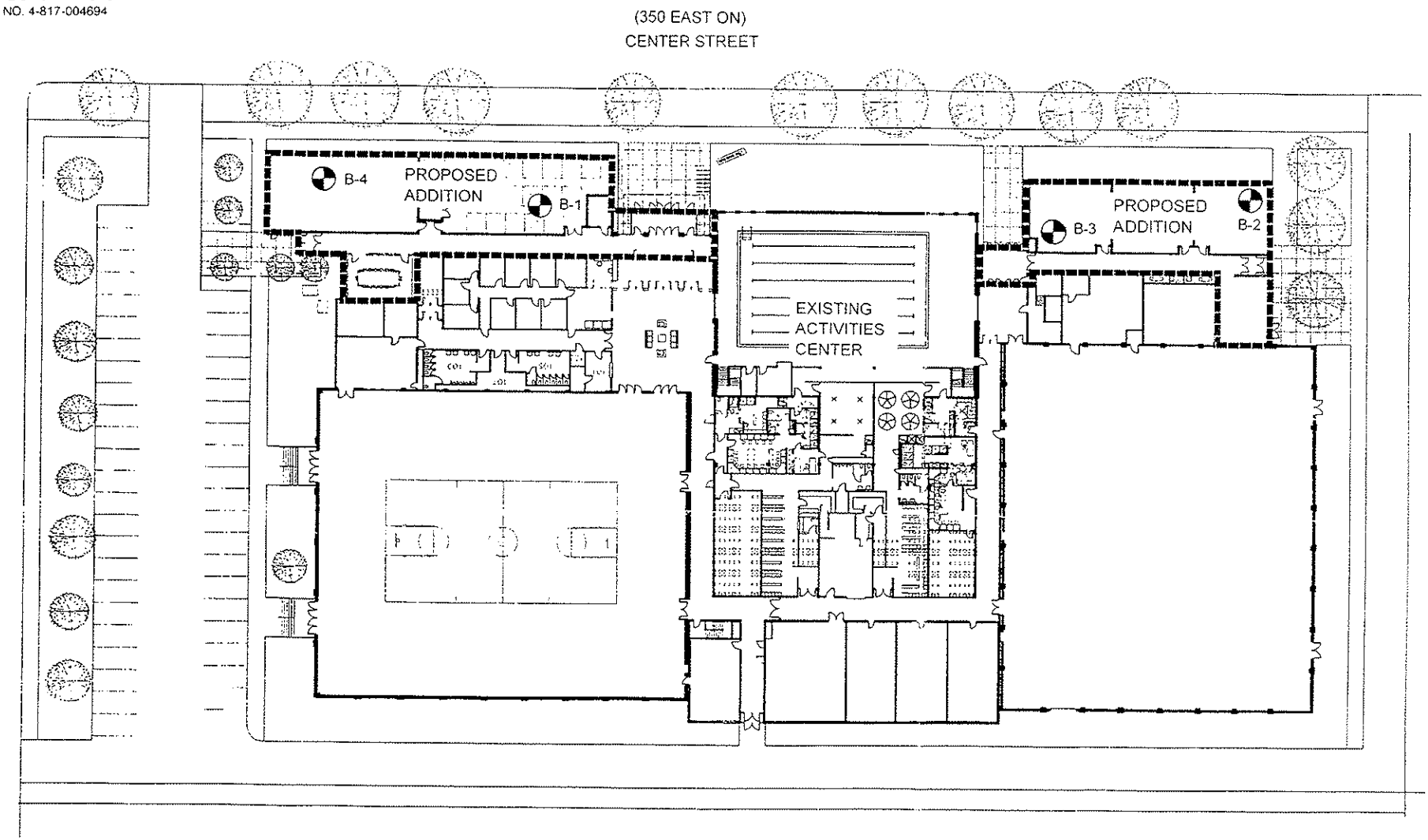

FIGURE 2
SITE PLAN

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"ARCHITECTURAL SITE PLAN, SHEET AS101,
SNOW COLLEGE ACTIVITIES CENTER ADDITION/REMODEL"
BY GOULD EVANS ASSOCIATES, L.C., DATED DECEMBER 22, 2003

40 20 0 40
SCALE IN FEET

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N117725

PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-1

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL/ ML FILL	frozen 6"-12" moist stiff	**SILTY CLAY/CLAYEY SILT** with some fine to coarse sand; trace coarse gravel; major roots (topsoil) to 3"; brown; FILL
				D	14	118	10.5			
								CL/ ML	moist to slightly moist medium stiff	**SILTY CLAY/CLAYEY SILT** with some pinholes and rootholes; brown
				D	10	89	15.3			
5										
				D	12	98	19.6		moist stiff	grades with some fine sand without pinholes
10										
				D	9	102	19.3		medium stiff	
15										
				D	11					grades with occasional up to 1" layers silty fine sand
20										
				D	11					grades with occasional charcoal pieces and dark
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3A

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PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-1

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25										brown layers
										Stopped drilling at 24.0'.
										Stopped sampling at 25.5'.
										* Groundwater not encountered.
30										
35										
40										
45										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
50										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3A
(con't)

amec

PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL	frozen to 6" moist medium stiff	**FINE SANDY CLAY** with occasional 1" to 3" layers of silty fine sand; major roots (topsoil) to 2"; brown
				D	7					
5				D	7	97	22.9			
									stiffer drilling	
10				D	7	103	19.9			grades with trace charcoal pieces and with occasional 1" to 2" layers with trace pinholes
										grades with numerous 1" to 3" layers silty fine to medium sand, trace coarse sand, and fine gravel without pinholes
15				D	11					
20				D	21	112	17.3			grades with trace pinholes
								SM	moist medium dense	**SILTY FINE SAND**; trace medium to coarse sand and fine gravel with trace pinholes; brown
								CL	moist medium stiff	**FINE TO COARSE SANDY CLAY** with numerous pinholes; brown
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3B

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PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				D	37					
								GP	moist very dense	**FINE AND COARSE GRAVEL** with some fine to coarse sand; brown
										Stopped drilling at 25.0'. Stopped sampling at 26.5'. * Groundwater not encountered.
30										
35										
40										
45										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
50										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3B
(con't)

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PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-3

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL/ ML FILL	frozen to 8" moist medium stiff	**SILTY CLAY/CLAYEY SILT** with occasional sands and gravels up to 3" wide; major roots (topsoil) to 2";
				D	8	99	22.5			grades with occasional pieces of coal
5				D	5	96	22.1	CL	moist medium stiff	**FINE SANDY CLAY**; brown
10				D	6				very moist	grades with occasional 2" layers silty fine sand
15				D	10			SM	moist loose	**SILTY FINE SAND**; trace medium to coarse sand and fine gravel with occasional fine sandy clay layers to 2"; no pinholes; brown
20										Stopped drilling at 14.0'. Stopped sampling at 15.5'. * Groundwater not encountered. The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3C

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PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-4

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL/ ML FILL	frozen to 8" moist medium stiff	**SILTY CLAY/CLAYEY SILT** with some fine to coarse sand and trace fine and coarse gravel; major roots (topsoil) to 2"; dark brown
				D	11	99	22.8	CL/ ML	moist medium stiff	**SILTY CLAY/CLAYEY SILT** with trace fine sand and occasional 1" to 3" layers fine sandy silt; brown with occasional black charcoal pieces
5				D	6	100	16.1	SM/ ML	slightly moist very loose	**SILTY FINE SAND/SANDY SILT** with trace pinholes and rootholes; brown
								CL/ ML	slightly moist stiff	**SILTY CLAY/CLAYEY SILT** with some fine sand; brown with some black charcoal pieces
10				D	16					
15				D	19	107	11.2			grades with numerous 1/4" to 1" fine sand layers and some pinholes and dark brown layering
20				D	22					grades to with occasional silty fine sand layers to 1" thick; no pinholes
25										grades sandy clay with

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3D

amec

PROJECT Snow College Activities Center
Ephraim, Utah

LOG OF TEST BORING NO. B-4

JOB NO. 4-817-004694 DATE 01-23-04

RIG TYPE CME 550
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25										numerous pinholes
				D	83	124	7.2	SP/ GP	slightly moist dense	FINE TO COARSE SAND AND FINE AND COARSE GRAVEL; brown
										Stopped drilling at 26.5'.
										Stopped sampling at 26.5'.
30										* Groundwater not encountered.
35										
40										
45										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
50										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 3D
(con't)

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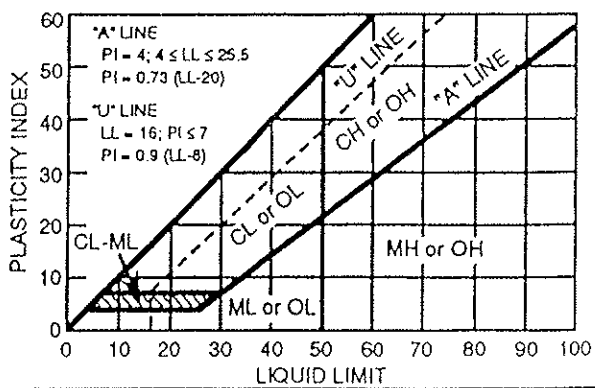
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands
					SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS Limits plot below "A" line & hatched zone on plasticity chart	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)			ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS Limits plot above "A" line & hatched zone on plasticity chart	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

FIGURE 4

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Memorandum

To Justin Nadauld – Reaveley Engineers
David McKay – DFCM
Mark Harris – Reaveley Engineers
Kevin Blaylock – Gould Evans

Job No. 4-817-004694

From Matt Gallegos/Bill Gordon – AMEC

Date April 6, 2004

Subject Lateral Earth Pressure Recommendations
Addition to Existing Activities Center
Snow College Activities Center Facility
Ephraim, Utah

As requested by Justin Nadauld of Reaveley Engineers, lateral earth pressure recommendations were developed for the additions to the Snow College Activities Center Facility located in Ephraim, Utah. The proposed additions will have first level floor slabs a few feet over adjacent exterior grades. The exterior walls will be designed to retain the floor slab subgrade fills. This memorandum supplements our geotechnical report dated February 16, 2004[1].

To limit lateral earth pressures on the subgrade walls, we recommend that the backfill extending four feet from the walls consist of granular soils and compacted to project specifications utilizing hand-operated equipment.

Compaction of each loose lift should begin at the back of the wall and proceed away from the back of the wall. The compactor equipment pattern should be parallel to the wall.

Walls that will rotate away from fill will be in an active earth pressure state. If the walls are laterally braced before backfilling, the walls will be in or near an at-rest earth pressure state.

In evaluating active and at-rest lateral earth pressure parameters, we have projected that the backfill material behind the walls will have a moist unit weight of 130 pounds per cubic foot and an internal friction angle of 34 degrees.

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[1] "Report, Geotechnical Study, Additions to Existing Activities Center, Snow College Activities Center Facility, Ephraim, Utah," Job No. 4-817-004694.

AMEC Earth & Environmental, Inc.
4137 South 500 West
Salt Lake City, Utah 84123
Tel: +1 (801) 266-0720
Fax: +1 (801) 266-0727 www.amec.com

The table below summarizes the lateral earth pressure criteria for both static and seismic conditions. The seismic lateral earth pressures are based on ⅔ of the USGS horizontal ground acceleration value of 0.328g, which correspond to a ground motion return period of 2,475 years (2% in 50 year event). These horizontal coefficients include amplification for a Site Class "D" soil profile.

Load Condition	Equivalent Fluid Density (pcf) Based on Mapped USGS Acceleration Values (⅔ of 2,475 yr event)	
	Static	2,475-Year Event
Active (free to rotate)	35	34[(1), (3)]
At-Rest (restrained)	65	28[(1), (3)]
Passive	600[(2)]	540[(2)]

(1) Seismic value only. In addition to static values. See following discussions.
(2) This is the ultimate passive resistance. Recommend that a factor of safety of at least 1.5 be applied. This will reduce the lateral movement required to develop the resistance
(3) The subgrade walls will act somewhere between active and at-rest. Therefore, a seismic value of 50 pounds per square foot is recommended.

It must be reiterated that the lateral earth pressure criteria provided in the preceding tables apply only for materials meeting the requirements of this memorandum and our original geotechnical report, and which are placed and compacted as described in this memorandum. If materials other than those described above are used as backfill immediately adjacent to the walls, or the backfill materials are placed and compacted differently than recommended herein, the above equivalent fluid densities must be modified.

It should be noted that the equivalent fluid density values provided above are based on the assumption that the backfill materials will not become saturated. The equivalent fluid density values may be decreased by 50 percent if the backfill becomes saturated. However, full hydrostatic water pressures will have to be included, and hydrodynamic pressures may need to be considered.

In determining the lateral earth pressures acting on retaining walls, we recommend the following approaches:

Active and At-rest Conditions

1. Static active and at-rest earth pressures alone are determined using the above static equivalent fluid density value and are applied using a triangular distribution that increases with depth below top of wall. The total static active force is applied at a point located one-third of the height of the soil retained above the base of the wall.

2. Seismic active and at-rest earth pressures alone are applied using an "inverted" triangular distribution that decreases with depth below the top of the wall. The total seismic active force is applied at a point above the base of the wall equivalent to six-tenths the height of the retained soil.

3. The total active and at-rest seismic earth pressure is the summation of the static and seismic components.

If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Matthew C. Gallegos

Matthew C. Gallegos
Staff Geotechnical Engineer

Reviewed by:

William J. Gordon, State of Utah No. 146417
Professional Engineer

MCG/WJG:sn

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. Work phases.
4. Work under other contracts.
5. Products ordered in advance.
6. Owner-furnished products.
7. Use of premises.
8. Owner's occupancy requirements.
9. Work restrictions.
10. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Snow College – Activities Center Dance Studio Addition, DFCM Project No. 05266700.

1. Project Location: Snow College Campus, Activities Center, Ephraim, Utah.

B. Owner: State of Utah, Department of Facilities and Construction Management.

1. Owner's Representative: Kurt Baxter.

C. Architect: Gould Evans, contact: Joe Smith, Project Manager.

D. Project Coordinator: Bob Oliver, Snow College.

E. The Work consists of the following:

1. The Work includes, at the Dance Studio Addition – Construction of dance studio facility, conference room, unisex restroom and storage room and all related vestibules and corridors. Construction of site improvements including sidewalk slabs, retaining walls, grading, landscape and all other related site improvements at the new dance studio location.

2. The Work includes, at the existing north Entry Vestibule to the Activities Center – Construction of new vestibule extension/addition as well as the removal and repair of the existing interior vestibule doors. Construction of site improvements including sidewalk, grading and all other related site improvements at the new vestibule extension/addition location.

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.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day 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.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by 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.

END OF SECTION 01100

SECTION 01140 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Refer to Civil, Architectural and Electrical site plans for utility and site work required to provide uninterrupted service and access to adjacent facilities and areas.

1. Limits: Confine constructions operations to within the Contract Limit line.
2. Owner Occupancy: Allow for Owner and public access and use of College campus.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, the public 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.

1.3 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy adjacent areas around site and existing building during entire construction period. 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.

B. Partial Owner Occupancy: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will provide, operate, and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01140

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. Notification of acceptance of Deferred items is to be within 120 days of Contract date. 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. Add Alternate #1 – Projected windows on dance studio. This alternate includes all work associated with construction of the projected windows. Scope of work is as indicated in the drawings as "-alt" (for example the alternate building elevations are found on sheet "AE201alt", etc.), and includes but is not limited to: structural steel framing, curtain wall glazing, finishes as indicated, including wood panels and panel attachment details.

B. Base bid shall include only the storefront window systems denoted on sheets, in lieu of the sheets noted as "-alt" or "alternate".

END OF SECTION 01230

SECTION 01250 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 1 Section "Unit Prices" for administrative requirements for using unit prices.
2. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

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

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or a maximum of 14 days after receipt of Proposal Request, submit a quotation estimating cost adjustments, if any, to the Contract Sum and the Contract Time necessary to execute the change.

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

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

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

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

D. Proposal Request Form: For Change Order proposals, use forms provided by Owner. Sample copies are included herein.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, or request for equitable adjustment, Architect will issue a Change Order for signatures of Owner and Contractor on Owners change order form, included is a copy or as part of the Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

SECTION 01270 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Quality Requirements" for testing and inspecting requirements.
   2. Division 1, Section “Contract Modification Procedures.”

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

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

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

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

D. List of Unit Prices: A supplemental Bid Form has been provided for indicating proposed Unit Prices for items identified. Refer to that form in the BYU-Idaho Contract Requirements section for items to be priced based on unit costs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

END OF SECTION 01270

SECTION 01290 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

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

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.5 APPLICATIONS FOR PAYMENT

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

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

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

C. Payment Application Forms: AIA forms G702 and G703 shall be used for Contractor Application and Certificate for Payment forms.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

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

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

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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.

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

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

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

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

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

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

1.4 SUBMITTALS

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

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

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

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

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

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

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

1.6 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

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

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

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

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

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and

installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Required performance results.
    u. Protection of construction and personnel.

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

D. Progress Meetings: Conduct progress meetings at bi-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.
    b. Review present and future needs of each entity present, including the following:

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

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

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

E. Coordination Meetings: Conduct Project coordination meetings at bi-weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

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 the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. Review present and future needs of each contractor present, including the following:

      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.

4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Submittals Schedule.
3. Daily construction reports.
4. Field condition reports.
5. Construction photographs.

B. See Division 1 Section "Payment Procedures" for submitting the Schedule of Values.

C. See Division 1 Section "Closeout Procedures" for submitting photographic negatives as Project Record Documents at Project closeout.

D. Division1 “General Conditions.”

1.2 DEFINITIONS

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

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

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

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

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

1.3 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.

5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

B. Preliminary Network Diagram: Submit two printed copies, one a single sheet of reproducible media and one a print, large enough to show entire network for entire construction period.

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

D. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Daily Construction Reports: Submit three copies at weekly intervals.

F. Field Condition Reports: Submit three copies at time of discovery of differing conditions.

1.4 COORDINATION

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

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

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

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

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

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

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

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

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 10 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect on the schedule of the following:

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

5. Work Stages: Indicate important stages of construction for each major portion of the Work.
6. Other Constraints: Coordination with Multiple Contracts.

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

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

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following:

   a. Preparation and processing of submittals.
   b. Purchase of materials.
   c. Delivery.
   d. Fabrication.
   e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording events at Project site, including the following:

1. List of subcontractors.
2. High and low temperatures and general weather conditions.
3. Accidents.
4. Stoppages, delays, shortages, and losses.
5. Meter readings and similar recordings.
6. Orders and requests of authorities having jurisdiction.
7. Services connected and disconnected.
8. Equipment or system tests and startups.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

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

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

3.2 CONSTRUCTION PHOTOGRAPHS

A. Photographic: Medium: 2 ¼ Digital, Min. by 2-3/4 inches (60 by 70 mm).

B. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

C. Periodic Construction Photographs: Take a minimum of four color photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken.

1. Field Office Prints: Retain one set of prints of periodic photographs in field office at Project site, available at all times for reference. Deliver one set of prints to Architect each month. Identify photographs the same for those submitted to Architect.

END OF SECTION 01320

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "General Conditions" for submitting Applications for Payment.
2. Division 1 Section "General Conditions" for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals.
5. Division 1 Section "Closeout Procedures" for submitting warranties Project Record Documents and operation and maintenance manuals.
6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
7. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 DEFINITIONS

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

B. Informational Submittals: Written information that does not require Architect's and DFCM's Project Managers responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. 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.

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

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.

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

3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow 10 days for processing each resubmittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

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 4 by 5 inches (100 by 125 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect and consulting engineer.
3. Include the following information on label for processing and recording action taken:

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

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

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

1. 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. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. **Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.**
3. Transmittal Form: Use AIA Document or G810 CSI Form 12.1A.
4. Transmittal Form: Provide locations on form for the following information:

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

H. 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.

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

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

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

1. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:

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

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

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

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

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

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

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

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
4. Number of Copies: Submit copies of each submittal, as follows:
   a. Initial Submittal: Submit two blue- or black-line prints. Architect will return one print.
   b. Final Submittal: Submit three blue- or black-line prints, unless prints are required for operation and maintenance manuals. Submit five prints where prints are

required for operation and maintenance manuals. Architect will retain two prints; remainder will be returned.

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

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

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

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

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

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

6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

    a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

7. Number of Samples for Initial Selection: Submit one full set[**s**] of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
8. Number of Samples for Verification: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

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

9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

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

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

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

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

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

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

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

2.2 INFORMATIONAL SUBMITTALS

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

1. Number of Copies: Submit two 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 in Division 1 Section "Quality Requirements."

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

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

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

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

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

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

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

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

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

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

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

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

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "

O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

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

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

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

R. Construction Photographs: Comply with requirements in Division 1 Section "."

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

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

3.2 ARCHITECT'S ACTION

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

B. 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 reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will 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 facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

1. Contractor shall be permitted to tie into existing building for temporary power and heat. Contractor shall be responsible to manage use of utilities responsibly.

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

1. Water service and distribution.
2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
3. Heating and cooling facilities.
4. Electric power service.
5. Lighting.

C. Support facilities may include, but are not limited to, the following:
1. Project identification and temporary signs.
2. Waste disposal facilities.
3. Field offices.
4. Temporary stairs.
5. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
1. Site enclosure fence.
2. Security enclosure and lockup.
3. Barricades, warning signs, and lights.
4. Covered walkways.
5. Temporary enclosures.
6. Temporary partitions.
7. Fire protection.

1.3 DEFINITIONS

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

1.4 USE CHARGES

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

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

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

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

1.5 SUBMITTALS

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

B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.6 QUALITY ASSURANCE

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

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

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

1.7 PROJECT CONDITIONS

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

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

C. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

E. Paint: Comply with requirements in Division 9 Section "Painting."

F. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

G. Water: Potable.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.
1. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

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

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

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

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

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

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

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

3.2 TEMPORARY UTILITY INSTALLATION

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

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

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

1. Provide rubber hoses as necessary to serve Project site.
2. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot (30-m) hose. Provide one hose at each outlet.

3. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

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

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.

   a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
4. Drinking-Water Facilities: Provide bottled-water, drinking-water units.

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

5. Locate toilets and drinking-water fixtures so personnel need not walk more than two stories vertically or 200 feet (60 m) horizontally to facilities.

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

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

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

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

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

G. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

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

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

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

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Provide one 100-W incandescent lamp per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.
3. Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.
4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
6. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

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

B. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
2. Prepare temporary signs to provide directional information to construction personnel and visitors.

3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.

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

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

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

E. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.

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

G. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. 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 (AS NEEDED)

A. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

B. 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.

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

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

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

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. (9.2 sq. m) in area, use fire-retardant-treated material for framing and main sheathing.

E. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on construction side.
2. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
3. Protect air-handling equipment.
4. Weatherstrip openings.

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

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

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

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

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

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

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

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

END OF SECTION 01500

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Alternates" for products selected under an alternate.
   2. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
   3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

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

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

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

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

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

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

1.4 SUBMITTALS

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

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

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

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

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

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

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

1. Substitution Request Form: Use CSI Form 13.1A, form provided by Owner or form provided at end of Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

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

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

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

1.7 PRODUCT WARRANTIES

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

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

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

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

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

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

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

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

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

   a. Substitutions may be considered, unless otherwise indicated.

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

   a. Substitutions may be considered, unless otherwise indicated.

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

   a. Substitutions may be considered, unless otherwise indicated.

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

   a. Substitutions may be considered, unless otherwise indicated.

5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product[**s**]" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Substitutions may be considered**, unless otherwise indicated**.

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

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

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

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

2.2 PRODUCT SUBSTITUTIONS

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

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

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner

must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

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

B. Related Sections include the following:
1. Division 1 Section "Submittal Procedures" for submitting surveys.
2. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording any of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

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

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

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

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

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

3.2 PREPARATION

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

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

1. Notify Architect and Owner not less than ten days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without **Architect's** and **Owner's** written permission.

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

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

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation" or the General Contractor's standard form.

3.3 CONSTRUCTION LAYOUT

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

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

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

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

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

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

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Owner's Project Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

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

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

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

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

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

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

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

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

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

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

3.6 OWNER-INSTALLED PRODUCTS

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

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

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

3.7 PROGRESS CLEANING

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

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

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

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

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

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials

specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

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

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

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

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

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

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

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

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

3.8 STARTING AND ADJUSTING

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

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

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

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

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.10 CORRECTION OF THE WORK

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

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

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

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

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

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

END OF SECTION 01700

SECTION 01702 – AIRTIGHT CONSTRUCTION FOR SOUND ISOLATION

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 DESIGNATED CONSTRUCTION

Some of the building construction on the project is designated "airtight" (leak-proof) for the purposes of sound isolation, including, but not limited to the following:

A. The Dance Studio designated as A102 on the floor plan

B. The conference room designated as A104 on the floor plan.

1.3 DESCRIPTION

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

B. Where construction is designated airtight, all details for airtightness that are appropriate shall be employed. The responsibility for airtight construction shall fall on the general contractor and all subcontractors. All work between trades must be coordinated in the field to insure that airtightness is achieved where scheduled or required.

C. Every precaution shall be taken to maintain construction completely airtight around construction that is designated airtight. Construction joints, structural penetrations, mechanical and electrical duct penetrations, pipe and conduit penetrations, electrical boxes and fixtures, cabinets, doors, access panels, windows, frames, supports, etc. all shall be built and installed in such manner as to prevent sound transmission. Provide lintels, extra frames, blocking, escutcheons, grouting, gaskets, packing, caulking, dense putties, taping, filling, etc. as required to stop sound transmission.

1.4 APPLICABLE STANDARDS, REQUIREMENTS, DETAILS, AND PRODUCTS

A. ASTM E497 (Standard Practice for Installing Sound-Isolating Lightweight Partitions).

B. ASTM C919 (Practice for Use of Sealants in Acoustical Applications).

C. Specific requirements listed below.

D. Details and products in the project documents.

1.5 SPECIFIC REQUIREMENTS

Airtight construction requirements for the project included (but are not limited to) the following:

A. Partition Bases: Provide 1/4" (high) continuous bead of acoustical sealant at all locations where gypsum board meets structural flooring. The depth of the sealant shall equal the thickness of the gypsum layer or layers.

B. Partition Heads: Provide the same detail as for bases at flat structure. Provide details in the project drawings for other conditions.

C. Partition or Ceiling Joints at Dissimilar Materials: Provide 1/4" continuous bead of acoustical sealant at all locations where gypsum board meets dissimilar material. The depth of the sealant shall equal the thickness of the gypsum layer or layers.

D. Partition/Partition or Partition/Ceiling Joints: Provide standard corner taping detail.

E. Pipe, Duct, Conduit, or Structural Penetrations: Provide 1/4" wide bead of acoustical sealant around perimeter of small penetrating elements with controlled openings. Provide details in the project drawings for other conditions. The depth of the sealant shall equal the thickness of the gypsum layer or layers.

F. Electrical Boxes 4"x 4" or Under: Provide 1/4" wide bead of acoustical sealant around perimeters of electrical boxes. The depth of the sealant shall equal the thickness of the gypsum layer or layers. Provide sheet caulking continuously around the back side of boxes.

G. Electrical, Lighting, or Other Recessed Boxes Over 4"x 4": Provide one layer of 5/8" gypsum board continuous around the back of such boxes. Caulk or tape all joints and caulk all conduit penetrations with acoustical sealant.

1.6 DETAILS AND PRODUCTS

Representative details for airtight penetrations, recessed elements, edges, etc. are shown in the project drawings. The product specification below designates specific materials and components to be used to accomplish airtight detailing. The Contractor shall be alert for conditions that may require special details or materials in order to achieve airtightness and shall bring these to the attention of the Architect.

PART 2 - PRODUCTS

2.1 LOW-DENSITY GLASS FIBER INSULATION

Long-strand glass fiber insulation of 1- to 2-pcf density, without covering, thickness as required for packing and filling small joints and openings behind sealants. Acceptable products are as follows:

A. Aerocor by Owens-Corning Fiberglas.

B. Microlite by Johns Manville.

C. Ultralite by CertainTeed.

2.2 HIGH-DENSITY CERAMIC OR MINERAL FIBER SAFING

Long-strand ceramic or mineral fiber insulation of minimum 6-pcf density, without covering, thickness as required for packing and filling large and/or critical openings, usually behind a sealant or putty. Acceptable products are as follows:

A. Fiberfrax by Standard Oil Engineered Materials, Fibers Division.

B. Thermafiber by U.S. Gypsum.

2.3 GENERAL PURPOSE ACOUSTICAL SEALANT

Long-lasting, permanently-flexible sealant with excellent adhesion for closing small openings and joints up to a maximum of 1" wide. Sealant backed with glass fiber packing, compressible joint filler or resilient backer rod. Acceptable products are as follows:

A. Acoustical Sealant by Tremco. A black synthetic rubber material suitable for concealed locations only.

B. Acoustical Sealant by U.S. Gypsum. A white water base material suitable for exposed or concealed locations, but not waterproof.

C. Sound Sealant by Ohio Sealants. A white water base or rubber base sealant suitable for concealed locations.

2.4 FIRE-BARRIER PUTTY

Non-shrinking, highly-adhesive, minimum 40-pcf density fire-barrier putty for closing large openings and joints typically over 1" wide. Applied full depth or backed with a dense safing, as detailed. Acceptable products are as follows:

A. CP 25N/S No Sag or CP25S/L Self Leveling Fire Barrier Caulk by 3M Electrical Products Division.

B. Type FSP Firestop Putty by Nelson Electric Division of General Signal.
C. Fyre Putty by Standard Oil Engineering Materials Company, Fibers Division.

2.5 FOAMED-IN-PLACE SILICONE SEALANT

Fire-resistant, minimum 17-pcf density, foamed-in-place silicone sealant for closing electrical ducts and cable trays where they penetrate constructions. Will expand and fill around and between separated cables. Usually applied full depth of construction between permanent or temporary dams. Acceptable product is 3-6548 Silicone RTV Foam by Dow Corning.

2.6 SHEET CAULKING (ELECTRICAL OUTLET BOX PADS)

Polybutene-butyl or equal fire-resistant pads with inert fillers, 1/4" x 4" x 8" or 1/8" x 6" x 8" in size for sealing the backs and sides of standard electrical back boxes. Available in sheets or pads of standard sizes.

A. Outlet Box Pads by Harry A. Lowry & Associates.

B. Type FSP Firestop Putty Pads by Nelson Electric.

2.7 FELT-LINED METAL SLEEVES

Sheet metal sleeve with felt lining for implementing a seal around a pipe, hanger rod or other round element penetrating a construction. Inside sleeve diameter to equal outside diameter of penetrating element. Exposed end of sleeve closed with acoustical sealant. Acceptable products are as follows:

A. Pipe Isolator by Eleen.

B. P-R Isolator by Potter-Roemer.

C. Trisolator by Stoneman Engineering.

2.8 SELF-ADHESIVE BUBBLE GASKETS

Nominal 1/4" x 1/2" compressible bulb of silicone rubber or polypropylene with self-adhesive on one side for providing an acoustical seal around the edge of an operating access panels. Typically set on jamb or head frame or stop to act as a compression seal. Acceptable products are as follows:

A. PF 181 by National Guard Products.

B. S88D or S88W Siliconseal by Pemko.

C. 797 or 797W by Reese Enterprises.

D. 10-5050 Doubleguard by Stanley Hardware.

E. WS176 by Ultra Industries.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION CONFERENCE

Prior to the start of installation of the Work of this Section, convene a pre-installation conference under provisions specified elsewhere. The Contractor and all subcontractors and trades responsible for Work in this Section shall be present to review areas of potential interference and conflict and to review the requirements for airtight construction to see that airtightness is achieved where scheduled or required.

3.2 INSTALLATION

The following is required for all construction which is designated airtight.

A. Extend construction to a minimum of 1/8" and a maximum of 1/2" of adjacent construction or penetrations to provide a suitable space for packing and caulking.

B. Cut openings in construction accurately for electrical boxes, piping, ductwork and other penetrating elements. Leave enough space around such elements so they remain free of rigid connection with the surrounding construction.

C. Prior to packing and caulking penetrations as detailed herein, verify that all penetrating elements such as piping and ductwork are free and clear of the opening to be packed and caulked.

D. Where multiple layers of gypsum board are used, stagger all joints in adjacent layers a minimum of 24".

E. Apply all acoustical sealants and caulks in accordance with the manufacturer's instructions.

END OF SECTION 01702

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General 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. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

      a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

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

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

1.4 SUBMITTALS

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

   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect and Owner's designated representative Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

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

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

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.
8. Operating systems of special construction in Division 13 Sections.

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

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

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

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

   a. Processed concrete finishes.
   b. Stonework and stone masonry.
   c. Ornamental metal.
   d. Matched-veneer woodwork.
   e. Preformed metal panels.

f. Roofing.
g. Firestopping.
h. Curtain wall system, storefront.
i. Finished wood flooring.
j. Aggregate wall coating.
k. Wall covering.
l. HVAC enclosures, cabinets, or covers.

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

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

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

3.3 PERFORMANCE

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

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

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

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

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

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

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. Demolition and removal of selected site elements.
3. Repair procedures for selective demolition operations.

B. Related Sections include the following:

1. Division 1 Section "Summary" for use of the premises and phasing requirements.
2. Division 1 Section "Work Restrictions" for restrictions on use of the premises due to Owner or tenant occupancy.
3. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
4. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
5. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
6. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.
7. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
8. 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.

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

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

1.5 SUBMITTALS

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

B. 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.

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

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

D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

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.
2. Before selective demolition, Owner will remove the following items:

    a. To be determined

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. Processed concrete finishes.
    b. Stonework and stone masonry.
    c. Preformed metal panels.
    d. Roofing.
    e. Firestopping.
    f. Window wall system.
    g. HVAC enclosures, cabinets, or covers.

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 authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. 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.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

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. 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.

C. 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.

D. 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.

E. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

F. Temporary Shoring: Provide and maintain interior and exterior 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 fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
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. Transport items to Owner's storage area designated by Owner.
5. 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.

F. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

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

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

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

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

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

K. Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Division 7 Section for new roofing requirements.

L. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

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 Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

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

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
3. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
4. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of 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 and Owner's designated representative 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. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

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

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

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit 3 copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

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

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

1.6 PROJECT RECORD DOCUMENTS

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

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

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

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

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

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

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

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

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

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

1.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

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

2. Maintenance Data:

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

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

1.8 WARRANTIES

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

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

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

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

1. Provide instructors experienced in operation and maintenance procedures.

2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner through Owner's designated representative with at least 7 days advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

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

1. System design and operational philosophy.
2. Review of documentation.
3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

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

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

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

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.

i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

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

m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

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

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

END OF SECTION 01770

SECTION 02080 - PIPED UTILITIES - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Piped utility demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

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

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

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

PART 2 - PRODUCTS

2.1 JOINING MATERIALS

A. Refer to individual Division 2 piping Sections for special joining materials not listed below.

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

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

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

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

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

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

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

F. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

G. Brazing Filler Metals: AWS A5.8, BCuP Series, or BAg1, unless otherwise indicated.

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

I. Solvent Cements for Joining Plastic Piping:

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

J. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.2 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

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

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

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

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

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

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

2.3 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.4 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive vinyl type with permanent adhesive.

D. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cold-air supply.
2. Yellow: Hot-air supply.
3. Blue: Exhaust, outside, return, and mixed air.
4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin; duct destination; and design flow.

E. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches ; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

F. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, [**polished brass**] [**or**] [**aluminum**].
2. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: [**1/16 inch (1.6 mm)**] [**1/8 inch (3 mm)**], unless otherwise indicated.
3. Thickness: 1/16 inch , for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Manufacturer's standard laminated plastic. Use colors and designs recommended by ASME A13.1.

1. Terminology: Match schedules as closely as possible. Include the following:

   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

2. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi , 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 2 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. [**PVC**] [**Steel**] Pipe Sleeves: For pipes smaller than NPS 6 .
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

J. Verify final equipment locations for roughing-in.

K. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:

   a. Near each valve and control device.
   b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   d. At manholes and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches , 1/2 inch high for distances up to 72 inches , and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use [**3000-psi** <**Insert other**>, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 02080

SECTION 02221 - BUILDING DEMOLITION

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. Demolition and removal of buildings and structures.
2. Demolition and removal of site improvements adjacent to a building or structure to be demolished.
3. Removing below-grade construction.
4. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:
1. Division 1 Section "Work Restrictions" for restrictions on use of the premises due to Owner or tenant occupancy of adjacent structures.
2. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Division 1 Section "Temporary Facilities and Controls" for temporary construction, protection facilities, and environmental-protection measures for building demolition operations.
4. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of building demolition.

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 recycled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

A. Qualification Data: For demolition firm.

B. Proposed Dust-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. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.

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

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

D. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of Work.

B. Owner will occupy another building immediately adjacent to demolition area. Conduct building demolition so Owner's operations will not be disrupted.

1. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

    a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be 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 is not permitted.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.

B. Project Record Documents: No project record documents are available to indicate the extent of previous structures on the site.

C. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Architect.

2.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
   3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

2.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, paving, walkways, landscape during demolition operations.

B. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.

   1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
   2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

a. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.

2.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing buildings and structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations.

B. Site Access and Temporary Controls: Conduct building 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 authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

2.5 MECHANICAL DEMOLITION

A. Remove buildings and structures and site improvements intact when permitted by authorities having jurisdiction.

B. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

C. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside of footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 2 Section "Earthwork."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

2.6 EXPLOSIVE DEMOLITION

A. Explosives: Use of explosives is not permitted.

2.7 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

2.8 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by building demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

2.9 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

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

2.10 CLEANING

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

END OF SECTION 02221

SECTION 02230 - SITE CLEARING

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. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.

B. Related Sections include the following:

1. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
3. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
4. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

A. Photographs sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

B. A Geo Consultants representative shall confirm that unsuitable soils have been removed prior to importing fill.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.

C. Notify utility locator service for area where Project is located before site clearing.

D. Dust Control: Keep dust at a minimum at all times during construction.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange to shut off indicated utilities with utility companies.

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

1. Notify Architect not less than two days in advance of proposed utility interruptions.

C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

C. Over excavations shall extend laterally a minimum of 5 feet beyond the perimeter of the structure and / or foundations and 3 feet beyond exterior flatwork and pavement areas, or to a distance equal to the depth of over excavation, whichever is greater.

D. A Geo Consultants representative shall confirm that the recommended removals of unsatisfactory soils have been accomplished.

E. Native soils exposed after over excavation shall be scarified to a depth of at least 6 inches, moisture conditioned to within 2 percent of the optimum moisture content for granular soils, and slightly above optimum for fine-grained soils, and re-compacted to at least 90 percent of maximum dry density by D-1557

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

SECTION 02231 - TREE PROTECTION AND TRIMMING

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 protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for limits placed on Contractor's use of the site.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary tree protection.
3. Division 2 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
4. Division 2 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
5. Division 2 Section "Landscaping" for tree and shrub planting and transplanting, tree support systems, and soil materials.

1.3 SUBMITTALS

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

B. 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.

C. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

D. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

1.4 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.

B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located, (Campus Arborist to be consulted).

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.

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

1. Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19-mm) sieve.

B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch (25 mm) in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches (100 mm) or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

B. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.

C. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches (75 mm) back from new construction.
2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

C. Moderate Fill: Where existing grade is more than 6 inches (150 mm), but less than 12 inches (300 mm), below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above elevation of finish grade and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches (150 mm) below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches (150 mm) minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist (Campus Arborist).

C. Pruning Standards: Prune trees according to ANSI A300 as follows:

1. Type of Pruning: Crown cleaning.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip branches removed from trees. Spread chips where indicated or as directed by Architect.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern (Campus Arborist to be consulted).
   1. Provide new trees of 6-inch (150-mm) caliper size and of a species selected by Campus Arborist when trees more than 6 inches (150 mm) in caliper size, measured 12 inches (300 mm) above grade, are required to be replaced.

C. Aerate surface soil, compacted during construction, 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 02231

SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Division 2 Section "Earthwork" for excavating and backfilling and for existing utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches (75 mm).

E. Shotcrete: Comply with Division 3 Section "Shotcrete" for shotcrete materials and mixes, reinforcing, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

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 that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, 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 authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlying construction and abandon remainder.
2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 02260

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches within building lines.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1, Section 01270 Unit Prices, for a schedule of unit prices.
2. Division 1, Section 01500 Construction Facilities and Temporary Controls.
3. Division 2, Section 02230 Site Clearing, for site stripping, grubbing, removing topsoil, and protecting trees to remain.
4. Division 2, Section 02240 Dewatering, for lowering and disposing of ground water during construction.
5. Division 2, Section 02231 Tree Protection and Trimming, for protecting and trimming trees to remain.
6. Division 2, Section 02260 Excavation Support and Protection.
7. Division 7, Section 07130 and 07141 for drainage of footings, slabs-on-grade, and walls.
8. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.
9. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:
1. Drainage fabric.
2. Separation fabric.

B. Samples: For the following:

1. 3-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
2. 12-by-12-inch sample of drainage fabric.
3. 12-by-12-inch sample of separation fabric.

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

1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each borrow soil material proposed for fill and backfill.

D. Blasting plan approved by authorities having jurisdiction, for record purposes.

E. Seismic survey agency report, for record purposes.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

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

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Project Manager not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's and Construction Manager's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Soil classifications GC, SC maybe used as fill under pavements.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 38-mm sieve and not more than 12 percent passing a No. 200 sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf ; ASTM D 4632.
2. Tear Strength: 40 lbf ; ASTM D 4533.
3. Puncture Resistance: 50 lbf ; ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft. ; ASTM D 4491.
5. Apparent Opening Size: No. 50 ; ASTM D 4751.

C. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf ; ASTM D 4632.
2. Tear Strength: 75 lbf ; ASTM D 4533.
3. Puncture Resistance: 90 lbf ; ASTM D 4833.
4. Water Flow Rate: 4 gpm per sq. ft. ; ASTM D 4491.
5. Apparent Opening Size: No. 30 ; ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXCAVATION, GENERAL

A. Classified Excavation: Excavation to subgrade elevations classified as earth.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch . Do not disturb bottom of excavations intended for bearing surface.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
1. Clearance: As indicated.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in unyielding bearing material to allow for bedding course.

3.7 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

   1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

   1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

   1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for record documents.
   3. Inspecting and testing underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Place and compact initial backfill of subbase material, free of particles larger than 1 inch , to a height of 12 inches over the utility pipe or conduit.

   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

D. Coordinate backfilling with utilities testing.

E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

F. Place and compact final backfill of satisfactory soil material to final subgrade.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

   1. Under walks and pavements, and in all areas affected by construction, except for areas listed below, use satisfactory soil material.
   2. Under steps and ramps, use engineered fill.
   3. Under building slabs, use engineered fill.
   4. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

   1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches 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, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

D. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch .
2. Walks: Plus or minus 1 inch .
3. Pavements: Plus or minus 1/2 inch .

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:

1. Place base course material over subbase.
2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
3. Shape subbase and base to required crown elevations and cross-slope grades.
4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
5. 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 satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 DRAINAGE COURSE

A. Refer to attached soils/geotechnical report.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02510 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and specialties outside the building for the following:

1. Water services.
2. Fire-service mains.
3. Aboveground water piping for applications other than water-service piping.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Valves and accessories.
2. Water meters and accessories.
3. Backflow preventers and assemblies.
4. Fire hydrants.
5. Fire department connections.

B. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For the following:

1. Water meters.
2. Valves.
3. Backflow preventers.
4. Protective enclosures.
5. Hydrants.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

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

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.5 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

C. Soft Copper Tube: **ASTM B 88, Type K** , water tube, annealed temper.

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

D. PE, ASTM Pipe: ASTM D 2239, SIDR Numbers 5.3, 7, or 9; with PE compound number required to give pressure rating not less than **160 psig** .

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.
2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

E. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

F. PVC, AWWA Pipe: AWWA C900, **Class 150** , with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains.
2. PVC Fabricated Fittings: AWWA C900, **Class 150 and Class 200**, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.4 JOINING MATERIALS

A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Soldering Flux: ASTM B 813, water-flushable type.

D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

E. UL/FM, Cast-Iron Gate Valves:

1. A**vailable** Manufacturers:

   a. American Cast Iron Pipe Co.; American Flow Control Div.
   b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
   c. Central Sprinkler Company.
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. Grinnell Corporation.
   f. Grinnell Corporation; Mueller Co.; Water Products Div.
   g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   h. McWane, Inc.; Kennedy Valve Div.
   i. McWane, Inc.; M & H Valve Company Div.
   j. NIBCO INC.
   k. United States Pipe and Foundry Company.

2. UL/FM, Nonrising-Stem Gate Valves: UL 262, FM-approved iron body and bonnet with flange bronze seating material, and inside screw.

   a. Minimum Working Pressure: 175 psig .
   b. End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

   a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
   b. East Jordan Iron Works, Inc.
   c. Grinnell Corporation; Mueller Co.; Water Products Div.
   d. International Piping Services Company.
   e. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   f. McWane, Inc.; Kennedy Valve Div.
   g. McWane, Inc.; M & H Valve Company Div.
   h. United States Pipe and Foundry Company.

2. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
3. Valve: AWWA, cast-iron, nonrising-stem, **resilient**-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch-diameter barrel.

1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

1. Amcast Industrial Corporation; Lee Brass Co.
2. Ford Meter Box Company, Inc. (The).
3. Grinnell Corporation; Mueller Co.; Water Products Div.
4. Jones, James Company.
5. Master Meter, Inc.
6. McDonald, A. Y. Mfg. Co.
7. Red Hed Manufacturing Co.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch- diameter barrel.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

E. Water-Meter Boxes: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.

2.7 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

B. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

1. Manufacturers:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
d. American Foundry Group, Inc.
e. East Jordan Iron Works, Inc.
f. Grinnell Corporation; Mueller Co.; Water Products Div.
g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
h. McWane, Inc.; Kennedy Valve Div.
i. McWane, Inc.; M & H Valve Company Div.
j. Troy Valve.
k. United States Pipe and Foundry Company.

2.8 FIRE DEPARTMENT CONNECTIONS

A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

1. Manufacturers:

a. AFAC, Inc.; Badger Fire Protection.
b. Elkhart Brass Mfg. Co., Inc.
c. Fire End & Croker Corporation.
d. Firematic Sprinkler Devices, Inc.
e. Grinnell Corporation.
f. Guardian Fire Equipment, Inc.
g. Reliable Automatic Sprinkler Co., Inc.
h. Smith Industries, Inc.; Potter-Roemer Div.

2. Connections: Two NPS 2-1/2 inlets and one **NPS 4** outlet.
3. Inlet Alignment: **Inline, horizontal Square**.
4. Finish Including Sleeve: **Rough chrome plated**.
5. Escutcheon Plate Marking: **AUTO SPKR**."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Underground Water-Service Piping: Use **any of** the following piping materials for each size range:

1. NPS 3/4 to NPS 2 : Soft copper tube, **Type K** ; wrought-copper fittings; and **soldered** joints.
2. NPS 3/4 to NPS 2 : PE, ASTM pipe; **molded PE fittings; and heat-fusion** joints.
3. NPS 3/4 to NPS 2 (DN 20 to DN 50): PVC, [**Schedule 40 pipe; PVC, Schedule 40**] [**Schedule 80 pipe; PVC, Schedule 80**] socket fittings; and solvent-cemented joints.

C. Underground Fire-Service-Main Piping: Ductile-iron or PVC AWWA C 900.

3.2 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve locations. Specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, **metal** seated, gate valves with valve box.

3.3 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
2. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
3. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install ductile-iron, piping according to AWWA C600 and AWWA M41.

G. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

H. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

I. Install PE pipe according to ASTM D 2774 and ASTM F 645.

J. Bury piping with depth of cover over top at least 60 inches with top at least 12 inches below level of maximum frost penetration.

K. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

L. Sleeves are specified in **Division 15 Section "Basic Mechanical Materials and Methods."**

M. Mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Anchor service-entry piping to building wall.

3.5 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.
4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up.

B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 WATER-METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written requirements.

B. Water Meters: Install displacement-type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water-meter inlets. Include valves on water-meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.8 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

C. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.9 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on **two** sides of each freestanding fire department connection. Refer to Division 5 Section "Metal Fabrications" for pipe bollards.

3.10 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.

B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.

C. Connect water-distribution piping to **existing water main** . Use **tapping sleeve and tapping valve service clamp and corporation valve**

D. Connect water-distribution piping to interior **domestic-water and fire-suppression** piping.

E. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer piping.

F. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig . Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.12 IDENTIFICATION

A. Install continuous underground **detectable** warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.13 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

   a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
   b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 02510

SECTION 02530 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sanitary sewerage outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

B. Force-Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig .

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backwater valves and cleanouts.

B. Shop Drawings: Include plans, elevations, details, and attachments:

C. Coordination Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet Indicate underground structures and pipe. Show types, sizes, materials, and elevations of other utilities crossing system piping.

D. Field test reports.

1.4 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Paragraph for applications of pipe and fitting materials.

2.3 PIPES AND FITTINGS

A. Ductile-Iron Sewer Pipe: ASTM A 746, for push-on joints.

1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Gaskets: AWWA C111, rubber.

B. PVC Sewer Pipe and Fittings: According to the following:

1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

a. Gaskets: ASTM F 477, elastomeric seals.

2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 , deformed steel.
3. .

2.5 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

1. **Available** Manufacturers:

   a. Josam Co.
   b. McWane, Inc.; Tyler Pipe; Wade Div.
   c. Smith, Jay R. Mfg. Co.
   d. Watts Industries, Inc.; Ancon Drain Div.
   e. Watts Industries, Inc.; Enpoco, Inc. Div.
   f. Zurn Industries, Inc.; Hydromechanics Div.

2. Horizontal Type: With swing check valve and hub-and-spigot ends.
3. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

1. **Available** Manufacturers:

   a. Canplas, Inc.
   b. IPS Corp.
   c. NDS, Inc.
   d. Plastic Oddities, Inc.
   e. Sioux Chief Manufacturing Co., Inc.

2.6 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

B. Identification: Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

C. Piping Applications: Include watertight joints.

1. NPS 4 and NPS 6 Ductile-iron sewer pipe; standard-pattern, ductile-iron fittings; gaskets; and gasketed joints.
2. NPS 4 and NPS 6 Corrugated PE drainage tubing, PVC socket-end fittings, gaskets, and gasketed joints.
3. NPS 4 and NPS 6 PVC sewer pipe and fittings, gaskets, and gasketed joints.

D. Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

E. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

F. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

G. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

H. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

I. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
2. Install piping with 36-inch minimum cover.

J. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

K. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.

1. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.
2. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.
3. PE Pipe and Fittings: As follows:

   a. Join pipe, tubing, and gasketed fittings with gaskets for watertight joints according to ASTM D 2321 and manufacturer's written instructions.
   b. Install according to ASTM D 2321 and manufacturer's written instructions.
   c. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

4. PVC Sewer Pipe and Fittings: As follows:

   a. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
   b. Install according to ASTM D 2321.

5. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

L. Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.

M. Install backwater valves in piping where indicated.

N. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow in sewer pipe.

O. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

P. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

Q. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

R. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi .

S. Make branch connections from side into existing piping, NPS 4 to NPS 20 . Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi .

T. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

U. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

3.2 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate reports for each test.
5. If authorities having jurisdiction do not have published procedures, perform tests as follows:

a. Sanitary Sewerage: Perform hydrostatic test.

1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
2) Close openings in system and fill with water.
3) Purge air and refill with water.
4) Disconnect water supply.
5) Test and inspect joints for leaks.
6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig .

b. Sanitary Sewerage: Perform air test according to UNI-B-6.

6. Manholes: Perform hydraulic test according to ASTM C 969 .
7. Leaks and loss in test pressure constitute defects that must be repaired.
8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02530

SECTION 02553 - NATURAL GAS DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping, valves, and service regulators for natural gas distribution outside the building.

B. See Division 15 Section "Fuel Gas Piping" for natural gas piping inside the building.

1.2 DEFINITIONS

A. Gas Main: Utility's natural gas piping.

B. Gas Distribution: Piping from gas main to individual service-meter assemblies.

C. Point of Delivery: Piping outlet from service-meter assembly.

D. Natural Gas Piping: Piping that conveys natural gas from point of delivery to natural gas utilization devices inside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Ratings:

1. Piping and Valves: **100 psig** minimum, unless otherwise indicated.
2. Service Regulators: **65 psig** minimum, unless otherwise indicated.
3. Service Meters: **10 psig** minimum, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For the following:

1. PE pipe and fittings.
2. Valves.
3. Service regulators. Indicate pressure ratings and capacities.

B. Shop Drawings: For natural gas service piping and service meter assembly. Include plans, elevations, sections, details, and attachments to other work.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with requirements of utility supplying natural gas and with authorities having jurisdiction for natural gas systems.

B. Comply with **ANSI Z223.1 or NFPA 54** for materials, installation, testing, inspection, and purging.

1.6 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 PIPES AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B; Schedule 40, black.

1. Malleable-Iron Fittings: ASME B16.3, Class 150, standard pattern, with threads complying with ASME B1.20.1.
2. Steel Flanges and Flanged Fittings: ASME B16.5.
3. Unions: ASME B16.39, Class 150, black malleable iron; female pattern; brass-to-iron seat; ground joint.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket type or ASTM D 3261, butt type with dimensions matching ASTM D 2513, SDR 11, PE pipe.

C. Transition Fittings: Manufactured pipe fitting with one PE pipe end for **heat-fusion** connection to PE pipe and with one ASTM A 53/A 53M, Schedule 40, steel pipe end for threaded connection to steel pipe.

D. Service-Line Risers: Manufactured PE pipe fitting with PE pipe inlet for **heat-fusion** connection to underground PE pipe; PE pipe riser section with protective-coated, anodeless, steel casing and threaded outlet for threaded connection to aboveground steel piping.

E. Components, Tapes, Gaskets, and Bolts and Nuts: Suitable for natural gas and as recommended by piping manufacturer.

2.3 VALVES

A. Valves, General: Manual operation, suitable for natural gas service, and with 100-psig minimum working-pressure rating.

B. Threaded Valves, NPS 1 and Smaller: Include listing by agency acceptable to authorities having jurisdiction.

C. Nonlubricated, Tapered Plug Valves: Brass or cast-iron body, with brass tapered plug; lever operation; and complying with ASME B16.33, MSS SP-78, UL 842. Include lever **and locking device**.

1. **Available** Manufacturers:

a. Essex Brass.
b. Lyall, R. W. & Company, Inc.
c. McDonald, A. Y. Mfg. Co.
d. Mueller Company.

D. Lubricated, Tapered Plug Valves: Cast-iron body, with lubricated, brass tapered plug; lever operation; and complying with ASME B16.33, MSS SP-78, UL 842. Include lever **and locking device**.

1. **Available** Manufacturers:

a. Mueller Company.
b. National Meter.
c. Nordstrom Valves, Inc.

E. Lubricated Plug Valves: Cast-iron body, with lubricated, tapered, or cylindrical plug; lever operation; and complying with ASME B16.38, MSS SP-78, UL 842. **Include locking device.**

1. **Available** Manufacturers:

a. Milliken Valve Co., Inc.
b. Nordstrom Valves, Inc.
c. Olson Technologies, Inc.; Homestead Valve Div.
d. R & M Energy Systems; Flow Control Div.
e. Walworth Company (The).

F. PE Valves: Made for gas distribution, with nut or flat head for key operation; and complying with ASME B16.40, UL 842.

1. **Available** Manufacturers:

    a. Kerotest Manufacturing Corp.
    b. Lyall, R. W. & Company, Inc.
    c. Nordstrom Valves, Inc.
    d. Perfection Corporation; Gas Products Div.

G. Earthquake Valves: ASCE 25 mechanical-operation and automatic-shutoff type with operating-pressure rating at least as great as system pressure.

1. Pipe Connections:

    a. NPS 2 and Smaller: Threaded.
    b. NPS 2-1/2 and Larger: Flanged.

2. **Available** Manufacturers:

    a. Pacific Seismic Products, Inc.
    b. Quake Defense, Inc.; Emergency Fail-Safe Systems.
    c. Safe T Quake.
    d. Seismic Safety Products, Inc.
    e. US QuakeKoso Canada, Inc.

2.4 SPECIALTIES

A. Valve Boxes: Cast-iron, two-section box. Include top section with cover with "GAS" lettering, bottom section with base to fit over valve and barrel 5 inches in diameter, and adjustable cast-iron extension of length required for depth of bury. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head and with stem of length required to operate valve.

B. Service Regulators: Natural gas service regulator complying with ANSI B109.4 listed for service regulators.

1. Construction: Single-stage, steel-jacketed, corrosion-resistant diaphragm type. Include atmospheric vent and elevation compensator.
2. Pipe Connections: Threaded.
3. **Available** Manufacturers:

    a. American Meter Co.
    b. Fisher Controls International.
    c. Invensys Energy Metering.
    d. National Meter.
    e. Schlumberger Limited.

C. Concrete Bases: Precast concrete made of 3000-psi- minimum, 28-day compressive strength reinforced concrete; at least 4 inches thick and 4 inches larger in each dimension than supported item, unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Close equipment shutoff valves before turning off gas to premises or piping section.

C. Inspect natural gas piping according to fuel gas code to determine that natural gas utilization devices are turned off in piping section affected.

D. Comply with fuel gas code requirements for prevention of accidental ignition.

3.2 PIPING APPLICATIONS

A. Flanges, unions, and transition and special fittings with pressure ratings same as or higher than system pressure rating may be used, unless otherwise indicated.

B. Aboveground Piping: Steel pipe, malleable-iron fittings, and threaded joints.

C. Underground Piping: PE pipe, PE fittings, and heat-fusion joints.

D. Underground-to-Aboveground Piping Connections: Service-line riser.

E. PE-to-Steel Piping Connections: Transition fitting.

3.3 VALVE APPLICATIONS

A. The following requirements apply unless noted otherwise by public utility.

1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping gas mains.
2. Underground: Use PE valves.
3. Aboveground, NPS 2 and Smaller: Lubricated tapered plug valves.

3.4 INSTALLATION

A. Install underground, natural gas distribution piping buried at least **36 inches** below finished grade.

B. Install underground, PE, natural gas distribution piping according to ASTM D 2774.

C. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

D. Terminate service-regulator horizontal vents or horizontal vent piping with reducing-elbow fittings with large end as outlet. Install fitting outlet turned down with corrosion-resistant insect screen in outlet.

E. Install PE shutoff valves on branch connections to existing underground, natural gas distribution piping. Install valves with valve boxes.

F. Install metal shutoff valves on aboveground, natural gas distribution piping.

G. Install earthquake valves aboveground, outside building, and according to listing applications.

H. Refer to Division 2 Section "Piped Utilities -- Basic Materials and Methods" for basic piping joint construction.

I. Connect gas distribution piping to natural gas source and extend to service-meter assemblies and points indicated. Connect to building's natural gas piping if it is installed; otherwise, terminate piping with caps, plugs, or flanges, as required for piping material. Refer to Division 15 Section "Fuel Gas Piping" for natural gas piping inside the building.

J. Install unions adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

K. Do not use natural gas distribution piping as grounding electrode.

L. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter, and earthquake valve.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

M. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape over natural gas distribution piping during backfilling of trenches for piping.

3.5 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas distribution according to requirements of fuel gas code and utility.

B. Repair leaks and defective valves and specialties and retest system until no leaks exist.

C. Report results in writing.

D. Verify correct pressure settings for service regulators.

END OF SECTION 02553

SECTION 02630 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes storm drainage outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.3 SUBMITTALS

A. Product Data: For cleanouts, and drains indicated.

B. Shop Drawings: For precast concrete manholes and other structures, including frames, covers, and grates.

C. Coordination Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet . Indicate underground structures and pipe. Show types, sizes, materials, and elevations of other utilities crossing system piping.

D. Field quality-control test reports.

1.4 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 PIPES AND FITTINGS

A. Corrugated PE Drainage Tubing and Fittings: AASHTO M 252, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings to form silttight joints.

B. Corrugated PE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.

C. PVC Sewer Pipe and Fittings: According to the following:

1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

2.4 CATCH BASINS

A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C 478 , precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, diameter, and lengths to provide depth indicated..
3. Gaskets: ASTM C 443 , rubber.
4. Pipe Connectors: ASTM C 923 , resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum, unless otherwise indicated.

2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

C.

2.5 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R.

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 , deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious ratio.

1. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 , deformed steel.

2.6 PROTECTIVE COATINGS

A. Description: 1- or 2-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Catch Basin Frames and Grates: On entire surfaces.

2.7 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round, gray-iron body with anchor flange and round, secured, gray-iron grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:

1. Medium Duty: In paved foot-traffic areas.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, backfilling, and identification materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.2 PIPING APPLICATIONS

A. Piping Applications: Include silttight, joints.

1. NPS 4 to NPS 6 (DN 100 to DN 150): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. NPS 8 to NPS 15 (DN 200 to DN 375): PVC sewer pipe and fittings, gaskets, and

3.3 SPECIAL PIPE COUPLINGS

A. Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

3.4 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use catch basins for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow piping and connect to site storm drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping with 32-inch minimum cover.

3.5 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Join and install pipe and fittings according to installations indicated.

B. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.

C. PE Pipe and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for siltight joints according to manufacturer's written instructions.
2. Install according to ASTM D 2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.6 CATCH-BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.8 DRAINAGE SYSTEM INSTALLATION

1. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

B. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

3.9 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems according to authorities having jurisdiction.

3.10 PROTECTION AND CLEANING

A. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

END OF SECTION 02630

SECTION 02813 – SITE IRRIGATION SYSTEM

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 OF WORK INCLUDED

A. This Section includes piping, valves, sprinklers, lawn sprinkler specialties, controls, and wiring for contractor to **DESIGN and INSTALL** the irrigation system. Refer to Landscape Sheet for areas and plant types to be irrigated.

B. The work required under this section consists of furnishing all labor, materials, accessories, equipment, and performing all operations necessary for the complete installation of the landscape irrigation system.

C. The Irrigation Contractor shall provide power to the irrigation control system. The Contractor is responsible for all-electrical equipment and connections from the power source to the controllers to the irrigation system, as per city codes and ordinances.

D. Related Sections include the following:

1. Division 2 Section "Water Distribution" for water supply piping, water meters, and backflow preventers.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.

D. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. NP: Nylon plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PTFE: Polytetrafluoroethylene plastic.
6. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Water Coverage:
   1. Drip irrigation for 100 percent of planting areas and tree pits.
   2. Head-to-head 100 percent coverage of turf areas.

B. Location of Sprinklers and Specialties: Designer to take precautions to avoid plantings and obstructions such as signs and light standards. Make minor adjustments necessary to avoid these items.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:

   1. Pressure Piping: 60-80 psi
   2. Circuit Piping: 60-80 psi

1.5 SUBMITTALS

A. Product Data: Include pressure rating, rated capacity, settings, and electrical data of selected models for the following:

   1. Water regulators.
   2. Water hammer arresters.
   3. Valves. Include aboveground and underground; general-duty, manual and automatic control, and quick-coupler types.
   4. Valve boxes.
   5. Sprinklers.
   6. Specialties. Include emitters, drip tubes, and other devices.
   7. Controllerss. Include wiring diagrams.

B. Materials List: List all materials by manufacturer's name and model number. Only materials and items of equipment so approved shall be used.

C. Shop Drawings: Contractor to provide a complete set of landscape irrigation plans including materials list and details for submittal to the Owner and Landscape Architect per these performance specifications. The plans shall include lawn sprinkler piping, plan layout and locations, types, sizes, capacities, and flow characteristics of lawn sprinkler piping components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controllers, and wiring. Show areas of sprinkler spray and overspray. Coordinate with Owner and local City water officials for existing main line location for tap and existing pressures. The Irrigation Contractor shall not begin construction and shall not be paid until all Shop drawings have been submitted and approved by the Owner and Architect.

D. Coordination Drawings: Show piping and major system components. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures.

E. Test Reports: As specified in "Field Quality Control" Article in Part 3.

F. Maintenance Data: To include in maintenance manuals specified in Division 1. Include data for the following:

   1. Water regulators.
   2. Automatic control valves.
   3. Sprinklers.
   4. Specialties.
   5. Controllers.

1.6 QUALITY ASSURANCE

A. Manufacturing Qualifications: Provide landscape irrigation system as a complete unit produced by **one** acceptable manufacturer for all portions of work including heads, valves, piping, controllers, and accessories. The Irrigation Contractor must request written permission to use multiple manufacturers for any portion of work. The Landscape Architect or Owner must grant permission for using multiple manufacturers prior to commencement of irrigation construction.

B. Irrigation Contractor shall be responsible for the design, layout, and installation of the landscape irrigation system and is responsible for complying with requirements of the Uniform Plumbing code, city specifications, all state and local codes / ordinances.

C. Product Options: Contractor drawings shall indicate size, profiles, and dimensional requirements of lawn sprinkler piping components and are to be based on specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered, but **must be approved** by the Owner and the Landscape Architect. Refer to Division 1 Section "Substitutions."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Comply with requirements of utility supplying water and authorities having jurisdiction for preventing backflow and back siphonage.

F. Comply with ASTM F 645, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."

G. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then, reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

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

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify all existing utility locations.

B. Investigate and determine available water supply, water pressure, and flow characteristics.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.9 SEQUENCING AND SCHEDULING

A. The Irrigation Contractor shall be responsible for scheduling and coordinating so as to facilitate the most expeditious completion of the project in a workmanlike manner.

B. Consult and coordinate other relevant specification sections to determine the extent and character of the work specified elsewhere, but related top that herein.

C. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.

D. Coordinate lawn sprinkler piping with site work and time in such a way as to not disrupt other activities.

E. Schedule and coordinate all required irrigation utility connections with the project trades and/or utility companies. Coordinate all piping installation with the General contractor and with utility work.

F. Obtain information pertaining to the location of all existing utility lines and appurtenances prior to construction of irrigation system.

G. Provide at least two days notice to the Landscape Architect and the Owner prior to all required site visits as indicated herein.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Rain Bird Sprinkler Mfg., Co.
2. The Toro Co., Irrigation Division
3. Hunter Industries

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

1. Cast-Iron, Gate Valves for Underground Installation:

a. American AVK Co.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co.
d. East Jordan Iron Works, Inc.
e. Grinnell Corp.; Mueller Co.; Water Products Div.
f. McWane, Inc.; Clow Valve Co. Div.
g. McWane, Inc.; Kennedy Valve Div.

h. M & H Valve Co.
i. Stockham Valves & Fittings, Inc.
j. United States Pipe & Foundry Co.

2. PVC Valves for Aboveground and Control-Valve Box Installation:

a. Hayward Industrial Products, Inc.
b. Jomar International, Ltd.
c. Nibco, Inc.
d. Plast-O-Matic Valves, Inc.
e. Sloane: R & G Sloane Manufacturing Co., Inc.

3. Plastic, Automatic Control Valves:

a. Hunter Industries.
b. Rain Bird Sprinkler Mfg. Corp.
c. Telsco Industries; Weather-Matic Sprinkler Div.
d. Toro Co.; Irrigation Div.

4. Control-Valve Boxes:

a. American Drainage Products, Inc.
b. Applied Engineering Products.
c. Carson-Brooks Plastics, Inc.
d. DFW/HPI.
e. NDS, Inc.
f. Normandy Products Co.

5. Water Regulators:

a. Bermad, Inc.
b. Cla-Val Co.
c. Conbraco Industries, Inc.
d. FLOMATIC Corp.
e. GA Industries, Inc.
f. Honeywell Braukmann.
g. IMI Cash Valve, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Zurn Industries, Inc.; Wilkins Div.

6. Emitter and Drip-Tube Specialties:

a. Rain Bird Sprinkler Mfg. Corp.
b. Toro Co.; Irrigation Div.

7. Miscellaneous Specialties:

a. Buckner, Inc.
b. Rain Bird Sprinkler Mfg. Corp.
c. Telsco Industries; Weather-Matic Sprinkler Div.
d. Toro Co.; Irrigation Div.

8. Controllers:

a. Hunter Industries.
b. Rain Bird Sprinkler Mfg. Corp.
c. Telsco Industries; Weather-Matic Sprinkler Div.
d. Toro Co.; Irrigation Div.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" and "Valve Applications" articles for application of pipe and tube materials, joining methods, and valve applications.

2.3 PIPES AND TUBES

A. Coordinate this Article with "Pipe and Tube Fittings" and "Joining Materials" articles below and with "Piping Applications" Article in Part 3.

B. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

C. PVC Pressure-Rated Pipe: ASTM D 2241; PVC 1120 compound; SDRs 21, 26, and 32.5.

D. PE Controlled OD Pipe: ASTM F 771 and ASTM D 3035, PE 3408 compound, DRs 9 and 11.

E. PE Controlled ID Pipe: ASTM F 771 and ASTM D 2239; PE 3408 compound; SIDRs 7, 9, 11.5, and 15.

2.4 PIPE AND TUBE FITTINGS

A. Cast-Copper Fittings: ASME B16.18, solder-joint, pressure fittings.

B. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder joint, and threaded or solder-joint ends. Include threads complying with ASME B1.20.1.

C. Wrought-Copper Fittings: ASME B16.22, solder-joint, pressure fittings.

D. Cast-Bronze Flanges: ASME B16.24, Class 150, raised ground face, bolt holes spot faced.

E. PVC Socket Fittings, Schedule 40: ASTM D 2466.

F. PVC Socket Fittings, Schedule 80: ASTM D 2467.

G. PVC Threaded Fittings: ASTM D 2464.

H. Insert Fittings for PE Pipe: ASTM D 2609, NP or PP. Include bands or other fasteners.

I. PE Socket Fittings: ASTM D 2683.

J. PE Butt-Fusion Fittings: ASTM D 3261.

K. Transition Fittings: Manufactured assembly or fitting, with pressure rating at least equal to that of system and with ends compatible to piping where fitting is to be installed.

2.5 JOINING MATERIALS

A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.

B. Solder: ASTM B 32, Alloy Sn95 or E.

2.6 VALVES AND VALVE SPECIALTIES

A. Curb Stops: Bronze body, ground-key plug or ball, 150-psig (1035-kPa) minimum pressure rating, wide tee head, with inlet and outlet to match service piping material.

B. Cast-Iron Gate Valves: AWWA C500, cast-iron double disc, bronze disc, and seat rings or AWWA C509, resilient seated; bronze stem, cast-iron, or ductile-iron body and bonnet, stem nut, 200-psig (1380-kPa) working pressure; and ends that fit PVC pipe. Include elastomeric gaskets.

C. Cast-Iron, Rising-Stem Gate Valves: MSS SP-70, Type I, solid wedge; rising stem and flanged ends. Include all bronze trim; Class 125, ASTM A 126, cast-iron body; and handwheel.

D. Bronze, Rising-Stem Gate Valves: MSS SP-80, Type 2, solid wedge; rising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast bronze, with threaded or solder-joint ends. Include PTFE-impregnated packing, brass packing gland, and malleable-iron handwheel.

E. Bronze Ball Valves: MSS SP-110, Class 150, 600-psig (4140-kPa) cold working pressure. Include bronze, two-piece construction body with regular port; chrome-plated brass ball; blowout-proof stem; PTFE seats and seals; threaded-end connections; and lever handle.

F. Manual Control valves to be Bronze Globe Valves: MSS SP-80, Class 125, with fitting for key operation and underground application. Provide cast bronze bodies for Control valves, unless otherwise indicated.

1. Provide cast-bronze bodies, unless otherwise indicated.
2. Manual Control Valves: MSS SP-80, Class 125, globe valves.
3. Key-Operated, Manual Control Valves: MSS SP-80, Class 125, globe valves, fitted for key operation.
4. Automatic Drain Valves: Designed to open for drainage when line pressure drops below 3 psig (20 kPa).
5. Quick-Couplers: Factory-fabricated, 2-piece assembly. Include coupler water-seal valve; hose swivel with ASME Bl.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
    a. The valve body shall be constructed of heavy cast brass. The cover shall be a durable, protective self-closing rubber cover.
    b. The valve shall be opened and closed by a brass key of the same manufacturer having a ___" (MNPT) and ___ " (FNPT) outlet. The valve throat shall have a key-way with detent positions for regulating water flow.
    c. Locking Top Option: Include vandal-resistant, locking feature with 2 matching keys.
    d. Non-potable Option: The valve shall be constructed of heavy cast brass and shall have a purple, thermoplastic, locking rubber cover with molded-in warnings of "DO NOT DRINK" in English and Spanish, for use on systems using non-potable water.
    e. The quick coupling valve shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

G. Automatic Control Valves: Diaphragm-type, normally closed, with manual flow adjustment, and actuated by a 24 VAC 50/60 cycle solenoid.
    a. The valve pressure rating shall not be less than 200 psig (13,8 Bars).
    b. The valve body and bonnet shall be constructed of heavy-duty glass-filled UV resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced buna-n rubber.
    c. The valve shall have both internal and external a manual open/close control (internal and external bleed) for manually opening and closing the valve without electrically energizing the solenoid.
    d. The valve's internal bleed shall prevent flooding of the valve box.

e. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall open with 19.6 volt minimum at 200 psig (13,8 Bars). At 24 VAC average inrush current shall not exceed .23 amps.

f. The valve shall have a brass flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than 1 minute at 200 PSI, and less than 30 seconds at 20 PSI.

g. For non-potable or reclaimed water applications, the valve shall have a self-cleaning stainless steel screen designed for use in dirty water applications.

h. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

i. When operating pressure exceeds the following maximum operating pressure recommendations, electric remote control valves shall have a pressure regulating module (PRS-Dial) capable of regulating outlet pressure between 15 and 100 PSI (+/- 5 PSI). The regulator shall have a visible pressure indication scale ranging from 0-100 psi (0,0 to 6,9 bars) and an adjustment knob with detents that provide fine-tune adjustments in 1/2 psi (0,1 bar) increments. The protective cover shall snap tight to deter vandalism. A schrader valve shall be installed to accommodate a pressure hose gauge for monitoring pressure. The regulator shall be waterproof to prevent fogging the clear window and to prevent grit from binding internal components. The pressure shall be adjustable when the valve is manually internal bled or electronically activated. The regulator construction shall be such as to provide replacing the dial cartridge without removing the regulator housing or disturbing the valve installation.

j. Set each PRS-Dial according to the sprinkler type it supplies as indicated below.
   1) Large Pop-Up Rotary Sprinklers (40-80 radius): maximum 70 PSI.
   2) Medium Pop-Up Rotary Sprinklers (25-50 radius): maximum 50 PSI.
   3) Small Pop-Up Rotary Sprinklers (15-35 radius): maximum 40 PSI.
   4) Pop-Up Sprayheads (4-18 radius): maximum 30 PSI.

k. The valve shall be a PEB(S) as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

H. Plastic Valves: PVC with 150-psig (1035-kPa) minimum pressure rating, ends compatible with piping, and tee handle.

I. Valves in two paragraphs below are also available as "normally open." "Normally closed" valves automatically close if power failure occurs.

J. Automatic Drain Valves: Spring-loaded, ball valve of corrosion-resistant construction and designed to open for drainage if line pressure drops below 3 psig (20 kPa).

K. Curb-Stop Service Boxes: Cast iron with telescoping top section of length required for depth of bury of valve, cover with lettering "WATER," bottom section with base of size to fit over curb stop, and 3-inch- (75-mm-) diameter barrel. Include steel tee-handle shutoff rod with one pointed end, stem of length to operate curb stop, and slotted end fitting curb-stop head.

L. Valve Boxes for Main Lines: Cast iron with top section and cover with lettering "WATER," bottom section with base to fit over valve, 5-inch- (127-mm-) diameter barrel, and adjustable cast-iron extension of length required for depth of bury of valve. Include steel tee-handle, shutoff rod with one pointed end, stem of length to operate valve, and end fitting valve operating nut.

M. Manual Control-Valve Service Boxes: Cast iron with telescoping top section of length required for depth of bury of valve. Include cover with lettering "WATER," bottom section with base of size to fit over valve, and 3-inch- (75-mm-) diameter barrel. Include valve key, 36 inches (915 mm) long with tee handle and key end to fit valve.

N. Control-Valve Boxes: Fiberglass, polymer concrete, or precast concrete box and cover, with open bottom, openings for piping, and designed for installing flush with grade. Include size as required for valves and service application.

1. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3 inches (75 mm) maximum to 3/4 inch (19 mm) minimum.

2.7 SPECIALTIES

A. Water Regulators: ASSE 1003, single-seated, direct-operated, water-pressure regulators, rated for 150-psig- (1035-kPa-) minimum, initial-inlet working pressure, with size, flow rate, and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity.

1. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.
2. 2-1/2-Inch NPS (DN65) and Larger: Bronze or cast-iron body with flanged ends.
3. Interior Components: Corrosion-resistant materials.

B. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI WH-201 water hammer arrester. Include bellows or piston-type pressurized cushioning chamber and sizes complying with ASME A112.26.1M and PDI WH-201 Sizes A to F.

C. Pressure Gages: ASME B40.1 pressure gage. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.

D. Application Pressure Regulators: Brass or plastic housing, 3/4-inch NPS (DN20), with corrosion-resistant internal parts, and capable of controlling outlet pressure to approximately 20 psig (138 kPa).

E. Strainer/Filter Units: Brass or plastic housing, with corrosion-resistant internal parts, of size and capacity required for devices downstream from unit.

2.8 EMITTERS, DRIP TUBING, AND DEVICES

A. Each zone shall include a control zone kit and tubing/piping and emission devices.

B. Install emitters, drip tubing and devices, of type and size indicated, or as follows:

1. Dense plantings or shrub plantings less than 12 inches on center: Pop-up micro-spray device or inline emitter tubing.
2. Shrub plantings spaced greater than 12 inches on center: Single or multi-outlet, riser or tubing mounted emitter or inline emitter tubing.

C. Description: Manufacturer's standard units as shown on Drawings or as follows:

1. Application Control Zone:

a. The control zone kit shall have an isolation ball valve. The ball valve shall have a low-torque configuration permitting easy manual operation with 1 /4-turn on/off control and positive drip-tight shutoff. The ball valve shall have a body constructed of durable PVC and a rugged ABS handle.
b. The control zone kit shall have a 200-mesh in-line filter (RBY-C). The filter body shall be constructed of heavy-duty, glass-filled, UV-resistant polyester material providing a pressure rating of not less than 150 psi. The filter element shall be constructed of stainless steel. The standard 200-mesh (75-micron) screen shall be serviceable for cleaning purposes by both opening the ball valve connected to the flush port or unscrewing the cover from the body and removing the filter element. Color-coded replaceable filter elements of 30-mesh (500-micron) (yellow); 50-mesh (300-micron) (gold); 100-mesh (150-micron) (black); 150-mesh (100-micron) (blue); and 200-mesh (75-micron) (red) shall be

available from the same manufacturer of the in-line filter. The 1" filter body shall have a 1" (26/34) male threaded inlet and outlet. The design shall be of a "Y" body configuration. The dimensions for the 1" filter shall not exceed the following: Height: 6 1/2", Length: 4", Width: 4". The filter shall have a flow rate of 2 to 40 GPM with a pressure loss not to exceed 2 psi.

c. The control zone kit shall have an in-line pressure regulator with a preset outlet pressure of approximately 40 psi at a flow rate of 2-20 GPM. The regulator shall be constructed of durable, UV and heat-resistant, non-corrosive material providing an inlet pressure rating of not less than 90 psi. The 1" regulator shall have the ability to be installed above or below ground.

d. The control zone kit shall have a 1" commercial grade (PEB) irrigation control valve. The valve shall be a normally closed 24VAC 50/60 cycle, solenoid actuated, globe pattern design capable of a flow rate of 1-20 GPM with a pressure loss not to exceed 1.5 psi. The valve pressure rating shall not be less than 200 psi. The valve body and bonnet shall be constructed of heavy-duty glass-filled UV-resistant nylon and have stainless steel studs and flange nuts. The valve shall have a diaphragm constructed of durable Buna-N rubber material reinforced with nylon.

e. The control zone kit shall be a XCZ-100-COM as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

2. Inline emitter tubing

a. The flexible polyethylene tubing shall have factory installed, pressure-compensating, inline emitters installed every - inches. The flow rate from each installed inline emitter shall be a consistent – gallon per hour when inlet pressure is between 8 and 60 psi.

b. Pressure compensation shall be accomplished through the effective lengthening of the emitter flow path. This method of pressure compensation shall in no way reduce the size of the cross-sectional area of the emitter flow path. As a result, superior clog-resistance shall be achieved.

c. The inline emitter's cylindrical shape shall permit the welding of the emitter to the inner circumference of the polyethylene tubing. This shall create a physical barrier that keeps the cover of the inline emitter securely in place making it impossible to dislodge the emitter cover, or the silicone wafer beneath it, when the polyethylene tubing is kinked. This, in turn, shall assure consistent flow from each inline emitter throughout the line.

d. The inline emitter's cylindrical shape shall provide surface area for filtration throughout 360 degrees of its outer circumference. This increased filtration surface area shall assure that the water that enters the inline emitter can always come from the upper half, or cleanest part of the flow path in the polyethylene tubing regardless of how the inline tubing lays on the ground. This shall make it unnecessary to install an automatic flush valve on the system to drain the inline tubing after each watering cycle thereby saving significant water during system operation.

e. The inline emitter shall also have dual outlet ports, ensuring that only one port ever has direct contact with the ground when the polyethylene tubing is installed at grade and mulched over. This shall virtually eliminate the chance of back-siphoning debris into the tubing and eliminate the need to install an air relief valve at the highest point of the inline system.

f. The inline tubing shall be a Landscape Dripline as supplied by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

3. Pop-up micro spray device

a. The full or part circle pop-up spray type sprinkler shall be capable of covering 5-8 foot radius at 15-30 psi with a discharge rate of 0.02-0.52 GPM. The overall pop-up height shall be 6 inches.

b. The sprinkler body, stem, nozzle, and screen shall be constructed of heavy-duty, ultra-violet resistant plastic. It shall have a heavy-duty stainless steel retract spring for positive pop-down and a ratcheting system for easy alignment of the pattern.

c. The sprinkler body shall have a ribbed/flanged design at the inlet barb to the assembly that stabilizes the pop-up and protects the1/4" barb from possible damage.
d. The sprinkler shall have a soft elastomer pressure activated co-molded wiper seal for cleaning debris from the pop-up stem as it retracts into the case to prevent the sprinkler from sticking up and to minimize "flow-by".
e. The sprinkler shall have a matched precipitation rate (MPR) plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be capable of housing under the nozzle protective, non-clogging filter screens or pressure compensating (PCS) screens. The screen shall be used in conjunction with the adjusting screw for regulating. The pop-up sprinklers shall have a barb inlet which accepts 1/4 " distribution tubing for ease of installation.
f. The sprinkler shall have a durable, plastic snap-collar to secure 1 /4 distribution tubing to the outside of the pop-up case.
g. The sprinkler shall have a Pop-Top Flush Plug pre-installed. The plug shall prevent debris from clogging the sprinkler during installation and allow for system to be flushed before nozzling. The plug shall be bright orange in color and constructed of polypropelene material.
h. The sprinkler shall be a Xeri-Pop as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

4. Single outlet

a. The pressure compensated emitter body shall be constructed of UV and chemical resistant, non-corrosive delrin material. The emitter diaphragm shall be constructed of a silicone elastomer material.
b. The emitter shall deliver a nominal flow rate of 0.5-2 gallons per hour (GPH) at a pressure range of 15 to 50 pounds per square inch (PSI).The inlet barb shall be of a self piercing type, requiring no hole punch tool for insertion of the emitter into the tubing.
c. The emitter inlet barb shall be color coded to identify the flow rate of the unit as follows: 0.5 GPH - blue,1.0 GPH - black, 2.0 GPH. The emitter outlet shall be of a barbed configuration in which a vinyl tubing with an inside diameter of .160 can be attached. A series of baffles shall be molded into the outlet barb of the emitter.
d. The emitter shall be an XB-05, XB-10, or XB-20 as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

5. Emitters: Single outlet, Riser mounted

a. The pressure compensated emitter body shall be constructed of UV and chemical resistant, non-corrosive delrin material. The emitter diaphragm shall be constructed of a silicone elastomer material.
b. The emitter shall deliver a nominal flow rate of 1-2 gallons per hour (GPH) at a pressure range of 15 to 50 pounds per square inch (PSI).
c. The emitter shall have 1/2" female threaded inlet that can be mounted onto a 1/2" male threaded riser. The emitter outlet shall be of a barbed configuration in which a vinyl tubing with an inside diameter of .160 can be attached. A series of baffles shall be molded into the outlet barb of the emitter.
d. The emitter shall be a XBT-10, XBT-20 as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

6. Emitters: Multi-outlet, Riser mounted

a. The multi-outlet emitter manifold shall be manufactured out of UV resistant, non-corrosive ABS material for above or below grade installations. The unit shall have an integral 200 mesh fabric screen that can be serviced from the top of the unit by unscrewing the top cap. The unit shall have eight bottom mounted outlet ports that will accept vinyl tubing with a "160 inch inside diameter. The eight ports can be accessed through the top of the unit by unscrewing the lid from the base.

b. Each outlet port accepts a pressure compensating emitter of the same manufacturer controlling the flow from 0.5 to 24.0 gallons per hour per outlet. The unit shall have an operating range of 15 to 60 PSI.
c. The unit shall have a 1/2 inch female threaded inlet.
d. Include a subterranean emitter box manufactured of rugged UV-resistant thermoplastic construction. The emitter box body and cap shall be black in color.
Two slots in the bottom of the box shall be provided to allow for installation of distribution tubing onto the emission device. The dimensions on the unit shall be as follows: Height - 10.25", Top Diameter - 5.0", Base Diameter - 7.75".
e. The subterranean emitter box shall be the unit as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.
f. The multi-outlet emitter manifold shall be a MODEL XBD-80, XBD-81 manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

7. Drip Tubing: For emitters or other devices as necessary, of length as necessary, and with plugged end.

a. Size: 1/2-inch NPS drip tubing.

1) The polyethylene tubing shall be manufactured from high quality linear low density polyethylene resin meeting ASAE specifications.
2) The tubing shall be marked in bold print the manufacturers name, model number and date extruded at no less than 2.0 foot intervals.
3) The tubing shall have an inside diameter of .580 inches and an outside diameter of .700 inches. The tubing shall fit the same manufacturers 700 series compression fittings.
4) The tubing shall be XT-700 as manufactured for Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

b. Size: 1/4-inch NPS distribution tubing.

1) The vinyl tubing shall be extruded using virgin polyethylene and vinyl resins.
2) The tubing shall have a .160 inside diameter and a .220 outside diameter. The tubing shall fit onto the outlet barbs of all emitters marketed by the same manufacturer. The tubing shall be marked with the manufacturer's name at no less than 12 inch intervals.
3) Bug cap devices shall be used at the end of all 1/4" tubing to prevent insects from clogging the tubing.
4) The 1/4" vinyl tubing shall be DT-025 as manufactured for Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

2.9 AUTOMATIC CONTROL SYSTEM (CONTROLLERS)

A. Verify adequate zone allocation for new irrigation design. Locate controllers inside the building mechanical / maintenance area or as directed by the Owners Representative.

B. Description: Low-voltage controllers system, made for control of irrigation system automatic control valves. The controllers shall operate on an internal type transformer at 117 VAC +/- 10% at 60Hz and be capable of actuating up to two 24 VAC, 7VA, solenoid valves per station plus two master valves or pump start relays. The controllers shall be capable of operating two stations plus the master valves simultaneously. Controllers output and input shall be protected against severe electrical surge, and includes stations for at least the number of control valves as needed.

C. The irrigation system controllers shall be of a hybrid type that combines electromechanical and microprocessor based circuitry capable of fully automatic, semi-automatic and manual operation. The controllers will be housed in a weatherproof, lockable, 16 Ga. seamless steel cabinet suitable for wall mounting or free standing pedestal mounting.

D. The controllers shall have four separate irrigation programs (A, B, C & D) which may have different start times, watering days, and station timing. Each program shall be capable of up to 8 start times per day.

E. The controllers shall have 12-40 stations, as needed, each capable of an operating time of 0 to 2 hours in one-minute increments and 1 to 12 hours in 10-minute increments. The controllers shall be capable of automatic sequential stacking or assigned as overlapping operation to operate concurrently with the other programs if desired.

F. The controllers shall provide a separate water budget feature for each of programs. Water Budget shall allow simultaneous adjustment for all stations on a program from zero % of set running time to 200% of set running time. Adjustments shall be in 10% increments.

G. The controllers shall have a 365-day calendar with day-of-the-month OFF feature. Programs will run on an ODD/EVEN day cycle, day-of-the-week ON/OFF cycle or in cycles from 1 to 99 days. In addition, the controllers shall have a programmable rain shut-down from 1 to 99 days. Include provision for the following settings:

1. Setting to skip operation any day in timer period.
2. Setting for operation every other day.
3. Settings for operation 2 or more times daily.
4. Include manual or semi-automatic operation without disturbing preset automatic operation.

H. The controllers shall have two master valve/pump start circuits for use with a master valve to pressurize the system when the irrigation cycle starts, or to activate a remote pump start relay to run the pump during the irrigation cycle. One master valve/pump start circuit shall be ON/OFF programmable by station: the other shall function whenever a station is active.

I. The controllers shall be capable of being operated manually at any time. A manual single station, a group of stations, or a program can be selected to run for a programmed time without affecting the normal programmed run time. This controllers shall be capable of running a variable system test program without affecting the normal program, and the first station in the test cycle may be programmed for a longer run time.

J. The controllers shall be upgradeable by use of a Maxicom Interface Board.

K. The controllers shall have Cycle+Soak water management software that is capable of operating each station for a maximum cycle time and a minimum soak time to reduce water run-off and puddling. The maximum cycle time shall not be extended by water budgeting.

L. The controllers shall include a feature that allows the setting of a delay between station operation. This delay shall be set by program. This delay must be able to be set from 0 seconds to 99 hours.

M. The controllers shall have an internal non-volatile memory which will retain the irrigation program and the programmed date and time for a minimum of 100 years without power. A 9 VDC rechargeable battery and a recharging circuit shall also be included for counting down the program-in-progress during a power outage and allow programming of the controllers when disconnected from the main power supply.

N. There shall be a station status indicator light and a master valve status indicator light. Each station plus the master valve will be protected by a diagnostic circuit breaker, which will allow that station to be bypassed during a program. These lights will indicate station operation and circuit integrity.

O. The controllers shall have a diagnostic circuit breaker which identifies electrical shorts, provides a "FAULT" message on the LCD screen, skips shorted stations, and continues the irrigation cycle.

P. An indicator for sensor status will be found on the front panel along with a switch to suspend sensor operation. This indicator and override will work with a sensor wired to the controller's sensor terminals.

Q. Exterior Control Enclosures: Weatherproof enclosure with locking cover and 2 matching keys. Enclosure construction complies with NFPA 70 and NEMA 250, Type 4, and includes provision for grounding.

1. Material: 16 gauge, seamless, enameled-steel cabinet.
2. Material: Heavy-duty plastic cabinet.
3. Mounting: Free-standing-type stainless steel pedestal for concrete-pad mounting.
4. Mounting: Surface-type for wall mounting.

R. Interior Control Enclosures: Drip-proof enclosure with locking cover and 2 matching keys. Enclosure construction complies with NFPA 70 and NEMA 250, Type 12.

1. Material: Enameled-steel, sheet metal.
2. Material: Heavy-duty plastic cabinet.
3. Mounting: Surface-type for wall mounting.

S. The controllers shall be an ESP-MC as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.

T. Wiring: UL 493, solid copper conductor, insulated cable, suitable for direct burial.

1. Feeder Circuit Cables: Type UF, No. 12 AWG minimum, between building and controllerss.
2. Low-Voltage, Branch Circuit Cables: Type UF, No. 14 AWG minimum, between controllerss and automatic control valves. Jacket color is other than feeder-circuit-cable jacket color. Furnish cables with jackets of different colors for multiple cable installation in same trench.
3. Splicing Materials: Seal all direct bury wire connections with a waterproof wire connection for wet and direct burial applications. Comprised of a wirenut, immersed in a waterproof lithium gel, all contained in a UV resistant black plastic housing. The splice shall be a SPLICE-1 as supplied by Rain Bird Sprinkler Mfg. Corp., Glendora, California or equal.nsor:

U. Rain Sensor shall be of rugged construction to withstand the elements including exposure to sunlight (U.V. Rays). The sensor shall employ an electro-mechanical actuating device designed to cause a circuit interrupt that temporarily disables the timer-controllers and 24V, 7 VA solenoid valves (plus one master valve) after rainfall to adjustable quantities of 1/8", ¼", ¾" or 1". Sensor shall be accurate to within +/- 1/16th" and will restore the controllers power to a normal operating condition after 2-20 hours, depending on season and conditions. The device shall be suitable to be wired – normally closed (N.C.) – in series with the valve common; and shall include a short-lead to allow wiring normally open (n.).) when necessary. The device shall include UL listed switch rating of 10.1 amps, ¼ HP at 125/250 VAC. The device shall include a vent ring to help control drying time of the mechanical components. The sensor shall be located as directed by the Owner or Landscape Architect.

V. Freeze Sensor:

1. Freeze sensor shall keep irrigation system from operating during freezing or near freezing temperature. Sensor shall have a temperature set point of 4 degrees C + 3 degrees C (30 degrees F) and a temperature differential of 1+ degree C. The freeze sensor shall have electrical rating of 24 VAC 6 amps. Bracket and housing material shall be 6063 minimum. Location of sensor shall be as directed by the Owner or Landscape Architect.

2.10 IDENTIFICATION

A. Refer to Division 2 Section "Earthwork" for plastic underground warning-tape materials.

1. Solid blue film with continuously printed black-letter caption, "CAUTION--WATER LINE BURIED BELOW."
2. Solid blue film with metallic core and continuously printed black-letter caption, "CAUTION--WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 PREPARATION

A. Set stakes to identify proposed lawn sprinkler locations. Obtain Landscape Architect's approval before excavation.

3.2 TRENCHING AND BACKFILLING

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Refer to Division 2 Section "Hot-Mix Asphalt Paving" for cutting and patching asphalt paving.

C. Refer to Division 2 Section "Portland Cement Concrete Paving" for cutting and patching concrete paving.

D. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

E. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.

1. Install piping sleeves by boring or jacking under existing paving if possible.

F. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3 to 3/4 inch (75 to 19 mm) minimum, to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

G. Provide minimum cover over top of underground piping according to the following:

1. Pressure Piping: Greater depth of minimum of 36 inches (914 mm) below finished grade, or not less than 18 inches (500 mm) below average local frost depth.
2. Circuit Piping: 12 inches (300 mm).
3. Drain Piping: 12 inches (300 mm).
4. Sleeves: 24 inches (600 mm).

3.3 PIPING APPLICATIONS

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges instead of joints indicated.

C. Underground, Pressure Piping: Use the following:

1. 4-Inch NPS (DN100) and Smaller: Type L (Type B) soft copper tube, wrought-copper fittings, and soldered joints.

2. 2-Inch NPS (DN100) and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.
3. 4-Inch NPS (DN100) and Smaller: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.
4. 4-Inch NPS (DN100) and Smaller: Schedule 80 PVC pipe, PVC threaded fittings, and threaded joints.
5. 4-Inch NPS (DN100) and Smaller: SDR 21 PVC pressure-rated pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.
6. 2.5-Inch NPS (DN125) and Larger: Class 315 pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.
7. 5-Inch NPS (DN125) and Larger: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.
8. 5-Inch NPS (DN125) and Larger: SDR 21 PVC pressure-rated pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

D. Circuit Piping: Use the following:

1. 2-Inch NPS (DN50) and Smaller: Class 200 pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.
2. 2-Inch NPS (DN50) and Smaller: SDR 26 PVC pressure-rated pipe, schedule 40 PVC socket fittings, and solvent-cemented joints.
3. 2-1/2- to 4-Inch NPS (DN65 to DN100): Class 200 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

E. Underground Branches and Offsets at Sprinklers and Devices: Schedule 40 PVC pipe, PVC threaded fittings, and threaded joints. This will be required for all sprinklers over 1” or in all large areas of turf.

F. Risers to Aboveground Sprinklers and Specialties (Swing Joint Assembly): Schedule 40 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

G. Drain Piping: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

H. Drain Piping: SDR 21, 26, or 32.5 PVC pressure-rated pipe; Schedule 40 PVC socket fittings; and solvent-cemented joints.

I. Drain Piping: SIDR 9, 11.5, or 15 PE controlled ID pipe; insert fittings for PE pipe; and banded or coupled joints.

J. Sleeves: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

3.4 VALVE APPLICATIONS

A. Aboveground, Shutoff-Duty Valves: Use the following:

1. 2-Inch NPS (DN50) and Smaller: Bronze ball valve.

B. Underground, Shutoff-Duty Valves: Use the following:

1. 2-Inch NPS (DN50) and Smaller: Curb stop, with tee head, curb-stop service box, and shutoff rod.
2. 3-Inch NPS (DN80) and Larger: Gate valve, with elastomeric gaskets and stem nut, valve box, and shutoff rod.

C. Underground, Manual Control Valves: Bronze globe valve with control-valve service box and valve key.

D. Control Valves: Use the following:

1. 2-Inch NPS (DN50) and Smaller: Bronze diaphragm valve.
2. 2-Inch NPS (DN50) and Smaller: Plastic diaphragm valve.
3. 2-1/2- and 3-Inch NPS (DN65 and DN80): Bronze diaphragm valve.
4. 2-1/2- and 3-Inch NPS (DN65 and DN80): Plastic diaphragm valve.
5. 2-1/2- and 3-Inch NPS (DN65 and DN80): Cast-iron, nonrising-stem gate valve.

E. Drain Valves: Use the following:

1. 1/2- and 3/4-Inch NPS (DN15 and DN20): Plastic drain valve.
2. 1- to 2-Inch NPS (DN25 to DN50): Bronze ball valve.

3.5 JOINT CONSTRUCTION

A. Refer to Division 2 Section "Utility Materials" for pipe joint construction requirements.

B. PVC Piping Gasketed Joints: Construct underground joints between cast-iron valves and PVC pipe with elastomeric seals that fit pipe and valve ends. Use lubricant according to ASTM D 3139.

C. Dissimilar Piping Material Joints: Construct joints using adapters or couplings that are compatible with both piping materials, outside diameters, and system working pressure.

3.6 PIPING INSTALLATION

A. Locations and Arrangements: Drawings indicate location and arrangement of piping systems, which were used to size pipe and calculate friction loss, and other design considerations. Install piping as indicated, unless deviations are approved on Coordination Drawings.

B. Install piping at uniform slope of 0.5 percent minimum, down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and final connections to other components with 2-inch NPS (DN50) or smaller pipe connection.

G. Install flanges adjacent to valves and final connections to other components with 2-1/2-inch NPS (DN65) or larger pipe connection.

H. Install dielectric fittings to connect piping of dissimilar metals.

I. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

J. Lay piping on solid subbase, uniformly sloped without humps or depressions.

K. Install PVC piping in dry weather when temperature is above 40 deg F (4.4 deg C). Allow joints to cure at least 24 hours at temperature above 40 deg F (4.4 deg C) before testing, unless otherwise recommended by manufacturer.

L. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet.

M. Water Hammer Arresters: Install between connection to building main and circuit valves in valve box.

3.7 VALVE INSTALLATION

A. Underground Gate Valves: Install in valve box with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

B. Underground Curb Stops: Install in service box with top flush with grade.

C. Underground, Manual Control Valves: Install in manual, control-valve service box.

D. Control Valves: Install in control-valve service box.

E. Drain Valves: Install in control-valve box.

3.8 AUTOMATIC CONTROL SYSTEM INSTALLATION

A. Install controllerss according to manufacturer's written instructions and as indicated, if existing controllers in Shawnee II is not suitable. Verify with Owner.

B. Install control wiring in same trench with piping. Install wiring with loops at control valves and controllerss, at intervals not greater than 100 feet (30 m), and changes in direction to allow for expansion. Bundle wiring in same trench at 10-foot (3-m) intervals.

3.9 CONNECTIONS

A. Connect piping to sprinklers, valves, control valves, specialties, and accessories.

B. Connect water supplies to irrigation systems. Include backflow preventers at connections to potable-water supplies.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Ground electric-powered controllerss, valves, and devices.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power connections to controllerss, control valves, and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.10 FIELD QUALITY CONTROL

A. Testing: Perform hydrostatic test of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work.

1. Cap and subject the piping system to a static water pressure of 50 psig (345 kPa) above system operating pressure and without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.11 CLEANING AND ADJUSTING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Carefully adjust lawn sprinklers so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade after completion of landscape and turf installation.

D. Adjust settings of controllerss and automatic control valves.

3.12 COMMISSIONING

A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturers, proceed as follows:

1. Verify that specialty valves and their accessories are installed and operate correctly.
2. Verify that specified tests of piping are complete.
3. Verify that sprinklers and devices are correct type.
4. Verify that damaged sprinklers and devices are replaced with new materials.
5. Verify that potable-water supply connections have backflow preventers.
6. Energize circuits to electrical equipment and devices.
7. Adjust operating controls.

B. Operational Tests: Measure and record water flow rate and area coverage at each sprinkler. Adjust to achieve indicated values.

3.13 DEMONSTRATION

A. Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review maintenance information.

B. Provide seven days' advance written notice of demonstration to the Landscape Architect and Owner.

3.14 RECORD DRAWINGS AND INFORMATION

A. Furnish record drawings of the complete irrigation system. Indicate actual location of all valves and controls including piping. Show dimensions from easily identifiable existing features such as walls, curbs, fences, buildings, or walks.

B. **Maintain progress drawings** on the construction site at all times during installation of the irrigation system. Make a daily record of all work installed each day until completion of work.

C. Record Drawings and Controllers Chart:

1. Provide a complete set of up-to-date as-built drawings.

2. Prepare a controllers chart showing:

a. Location of all sections, valves, lateral lines and route of control wires.

b. Identify all valves as to size, station , number ant type of irrigation.

c. Provide chart as black line print with a different color used to show area of coverage or each station.

d. Location chart inside controllers door. Laminate chart and provide copy to Owner.

e. Complete chart and receive approval prior to final inspection of irrigation system.

3.15 WARRANTY AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following the completion and acceptance of the job.

B. Replacement Warranty. Warrant all replacement irrigation components for the warranty period indicated below, against defects and workmanship, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control. The Contractor shall replace warranted materials at his/her expense including labor any time acceptable to the Owner within one year after installation is accepted.

C. The Contractor shall drain the irrigation system in the fall of the first year, and start it up the following spring. Coordinate with Owner for proper dates of draining system and starting up for the system.

D. Warranty Period for Irrigation System: Three years from date of Substantial Completion or replacement date.

END OF SECTION 02813

SECTION 02930 – EXTERIOR PLANTS

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. Trees.
   2. Ornamental Grasses
   3. Other Misc Plantings

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
   2. Division 2 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

1.3 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

C. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

F. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

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

B. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
   1. Manufacturer's certified analysis for standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Planting Schedule: Indicating anticipated planting dates for exterior plants.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
   1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Architect may observe trees and plantings either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and plantings further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Architect of sources of planting materials 10 days in advance of delivery to site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.
   1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.
   3. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 COORDINATION

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

B. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Architect.
   1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.

B. Replacement Warranty. Warrant all replacement exterior plants for the warranty period indicated below, from the date of replacement, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
   1. Warranty Period for Trees and Shrubs: One year from date of Substantial Completion or replacement date.
   2. Warranty Period for Ground Cover and Plants: one year from date of Substantial Completion or replacement date.
   3. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
   4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

1.9 MAINTENANCE

A. Trees: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

1. Maintenance Period: Three months from date of Substantial Completion.

B. Ground Cover and Plants: Maintain for the following maintenance period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings:
   1. Maintenance Period: Three months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TREES

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

D. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
   1. Provide balled and burlapped trees.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
   1. Provide balled and burlapped and container-grown trees.

2.4 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.5 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.
   1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.

2. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.

2.6 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
2. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.7 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through **1-inch (25-mm)** sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content 50 percent of dry weight.
2. Compost may be produced from several feedstocks or raw materials. Revise types of feedstocks below if limiting sources. Revise descriptions and add product names if required.
3. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.8 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 15 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.9 WEED-CONTROL BARRIERS (Use is all rock mulch areas)

A. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

2.10 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

C. Guy Cable: 5-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.

D. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.11 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

2.12 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers per soil test reconmendations:
   1. Ratio of Loose Compost to Topsoil by Volume:
   2. Ratio of Loose Peat to Topsoil by Volume:
   3. Ratio of Loose Wood Derivatives to Topsoil by Volume:
   4. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m):
   5. Weight of [**Sulfur**] [**Iron Sulfate**] [**Aluminum Sulfate**] per 1000 Sq. Ft. (92.9 Sq. m):
   6. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m):
   7. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m):
   8. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m):
   9. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m):
   10. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m):

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. 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.

C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of **4 inches (100 mm)**. Remove stones larger than **1 inch (25 mm)** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Select from or retain both options in first subparagraph below for off-site or in-place mixing of planting soil.
   2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
   1. Excavate approximately three times as wide as ball diameter for balled and burlapped balled and potted container-grown fabric bag-grown stock.
   2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.

B. Subsoil removed from excavations may be used as backfill.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball **1 inch (25 mm)** above adjacent finish grades.
   1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

B. Set container-grown stock plumb and in center of pit or trench with top of root ball 1 inch (25 mm) above adjacent finish grades.
   1. Carefully remove root ball from container without damaging root ball or plant.

2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Set fabric bag-grown stock plumb and in center of pit or trench with top of root ball [**1 inch (25 mm)** above adjacent finish grades.
   1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

D. Organic Mulching: Apply **3-inch (75-mm)** average thickness of organic mulch after settlement has occurred. Do not place mulch within **3 inches (75 mm)** of trunks or stems.

3.6 TREE PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Architect.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.7 GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1830 mm) above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Use the number of stakes as follows:
   1. In subparagraph below, one stake may be acceptable for high-branched trees in semiprotected locations.
   2. Use 2 stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; 3 stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.

B. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) in height and more than 3 inches (75 mm) in caliper, unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches (760 mm) long, driven to grade.
   1. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.
   2. Paint turnbuckles with luminescent white paint.

3.8 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm).

1. Material and Seam Treatment: **Composite fabric with seams pinned**.

B. Mulch backfilled surfaces of planting beds and other areas indicated.
1. Retain type of mulch required from two subparagraphs below.
2. Organic Mulch: Apply **3-inch (75-mm)** average thickness of organic mulch after settlement has occured, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.11 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02930

SECTION 03301 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material.

B. Form-Facing Panels for architectural finishes: Steel, glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

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

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

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

B. Normal-Weight Aggregates: ASTM C 33, graded, 1-inch nominal maximum coarse-aggregate size.

C. Water: ASTM C 94/C 94M and potable.

D. Air-Entraining Admixture: ASTM C 260.

E. Synthetic Fiber: fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Definitions of Mix Properties:

1. Concrete Compressive Strength is the compressive strength at 28 days as tested per ASTM C39.
2. Slump Specified is maximum, not to exceed, tested in accordance with ASTM C143.
3. Air Content is by volume at point of placement and shall be plus or minus **1.5** percent that specified.
4. Water/Cementitious Materials Ratio is specified by weight.
5. Drying Shrinkage Limit is percentage change in length after 21 days of drying when tested per ASTM C157 with 4 inch x 4 inch x 11 inch specimen moist cured 7 days prior to drying.

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

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

D. Admixtures: Use admixtures according to manufacturers written instructions.

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

E. Air Content:

1. Provide 6 percent air content in all exterior concrete and concrete exposed to freeze thaw cycles.
2. Provide 3 percent air content in all building concrete except for footings, mat foundations and grade beams unless noted otherwise.
3. Do not allow air content of troweled finished floors to exceed 3 percent unless noted otherwise. When the air content of a trowel finished floor slab exceeds 3%; there is an increased risk for delaminations and blistering to occur. When this situation is present as in lightweight concrete, the contractor shall pay special attention to the finishing procedures to help minimize such risks. Refer to ACI 302.1R-96 "Guide for Concrete Floor and Slab Construction" for proper finishing guidelines.
4. The contractor shall be responsible for repair and/or replacement of concrete slabs with surface imperfections caused by improper finishing techniques.

F. Continuous and Spread Footings:

1. Minimum Compressive Strength, f'c = 3000.
2. Maximum Water/Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches.
4. Maximum Coarse Aggregate Size: 1.1/2 inch.

G. Grade Beams:

1. Minimum Compressive Strength, f'c = 4000 psi.
2. Maximum Water/Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches.
4. Maximum Coarse Aggregate Size: 1.1/2 inch.

H. Slabs on Grade:

1. Minimum Compressive Strength, f'c = 3000 psi at 28 days tested per ASTM C39.
2. Maximum Water Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches.
4. Maximum Coarse Aggregate Size: 1 inch.
5. Drying Shrinkage Limit: 0.045 percent.

I. Walls and Piers:

1. Minimum Compressive Strength, f'c = 4000 psi.
2. Maximum Water/Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Maximum Coarse Aggregate Size: 1 inch.
5. Drying Shrinkage Limit: 0.045 percent.

2.6 CONCRETE MIXING

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

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

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

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

3.2 STEEL REINFORCEMENT

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

3.3 JOINTS

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

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

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

3.4 FINISHING FLOORS AND SLABS

A. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots.

Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

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

3.5 SITE CONCRETE, INCLUDING RETAINING WALLS, RAMPS, CURBS, STAIRS

A. Architectural Concrete Finish: All concrete surfaces exposed to view shall have a smooth architectural finish. Match Architect's design reference sample, to satisfaction of Architect.

3.6 CONCRETE PROTECTING 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 ACI 301 for hot-weather protection during curing.

B. Cure concrete according to ACI 308.1.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION 03300

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

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

1. Face brick.

1.2 SUBMITTALS

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

B. Samples for each type and color of exposed masonry units and colored mortars.

1.3 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 96 inches long by 120 inches high.

2. Sample panel to include **at least two changes in brick plane and a window unit**.

3. Sample panel can be included in the finished Work, if acceptable by Architect and Owner.

PART 2 - PRODUCTS

2.1 COLORS, TEXTURES, AND PATTERNS

A. Exposed Masonry Units: Match sample.

2.2 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

B. Face Brick: ASTM C 216, Grade MW or SW, Type FBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
5. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

2.5 TIES AND ANCHORS

A. Materials:

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

B. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Wire: Fabricate from 1/4-inch- diameter, hot-dip galvanized steel wire.

C. Adjustable Masonry-Veneer Anchors

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

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

b. Capable of spanning air spaces up to 6 ½”.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 7 Section "Sheet Metal Flashing and Trim."

1. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.
2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.

B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 long.
2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

3. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

B. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

2.8 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

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

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections as indicated in the structural drawings.

B. Construction: Type 2, simple framing.

1.4 SUBMITTALS

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

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
4. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

1.5 QUALITY ASSURANCE

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

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

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

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

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

B. Corrosion-Resisting Structural Steel: ASTM A 588/A 588M, Grade 50 (345).

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

D. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: SSPC-Paint 25, Type I zinc oxide or alkyd.

B. Galvanizing Repair Paint: ASTM A 780.

2.3 GROUT

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

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

2.4 FABRICATION

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

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.

3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

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

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

2.5 SHOP CONNECTIONS

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

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

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

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

2.6 SHOP PRIMING

A. Shop prime steel surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 1, "Solvent Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

PART 3 - EXECUTION

3.1 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

3.2 FIELD CONNECTIONS

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

1. Joint Type: Snug tightened and Slip critical.

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

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
   a.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05120

SECTION 05210 - STEEL JOISTS

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. Open-web K-series steel joists.
2. KCS-type, open-web K-series steel joists.
3. LH-series long-span steel joists.
4. Joist accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads within limits and under conditions indicated.

B. Structural Performance: Provide special joists and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads: 20 psf
2. Live Loads: 30 psf Snow Load + Drift
3. Wind Loads: 90 mph Exposure C. Wind loading of 29 psf uplift.
4. Earthquake Loads: Seismic use group I. Sds = 0.58g, sdl = 0.28g Site Class D. Cs = 0.117.

C. Design joists to withstand design loads with live load deflections no greater than the following:
1. Roof Joists: Vertical deflection of 1/240 of the span.

1.4 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
2. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.

1.5 QUALITY ASSURANCE

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

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

2.3 OPEN-WEB K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Do not camber joists.

G. Camber joists according to SJI's "Specifications."

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications."

C. Bridging: Fabricate as indicated and according to SJI's "Specifications."

1. Furnish additional erection bridging if required.

D. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

E. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

F. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

G. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

C. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.

E. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Field welds will be visually inspected according to AWS D1.1.

C. Bolted connections will be visually inspected.

1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

D. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

END OF SECTION 05210

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

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

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck 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. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:

1. Prime-Painted Steel Sheet: ASTM A 611, Grade C minimum, shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches (38 mm) and 3 inches (76 mm)
4. Design Uncoated-Steel Thickness: As indicated on drawings.
5. Span Condition: Triple span or more.
6. Side Laps: Interlocking seam.

2.2 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated.

F. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

G. Galvanizing Repair Paint: ASTM A 780.

H. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate decking bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.2 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 3/4 inch (19 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or **12 inches**, and as follows:
1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:

1. End Joints: Lapped 4 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least 1 weld at each corner.

E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.3 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:

1. Shear connector stud welds will be visually inspected.
2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 05310

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior load-bearing wall framing.
   2. Ceiling joist framing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

   1. Design Loads: As indicated on drawings.

   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
      b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.

   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

      a. Upward and downward movement of 3/4 inch (19 mm).

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.

   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing 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. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

PART 2 - PRODUCTS

2.1 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

2.2 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 2 inches (51 mm), minimum.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).

2.4 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet.

3.2 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

D. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

H. Install horizontal bridging in stud system to the dimension indicated on Shop Drawings apart. Fasten at each stud intersection.

I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.3 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at each end of joists and at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to bottom flange of joists.
2. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.4 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to inspection and testing.

C. Remove and replace Work that does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Loose bearing and leveling plates.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Aluminum plate and angle sections for window systems and wall base.

1.2 SUBMITTALS

A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

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

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

   1. AWS D1.1, "Structural Welding Code--Steel."

1.4 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

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

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500; ASTM 666, type 316 for stainless steel tubing.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads. Provide stainless steel pipe complying with ASTM 666, type 316.

2.3 ALUMINUM

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A with hex nuts, ASTM A 563 and, where indicated, flat washers.

C. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.6 FABRICATION, GENERAL

A. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.

B. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

E. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

F. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

G. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

H. Remove sharp or rough areas on exposed traffic surfaces.

2.7 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
   2. Furnish inserts if units must be installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim at exterior and interior locations where indicated:

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

   1. ASTM A 123, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 ALUMINUM FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I clear coating 0.7 mil (0.018 mm) or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

3.4 INSTALLING ALUMINUM PLATE

A. At window locations, fabricate trim pieces from ¼” thick anodized aluminum plate members.

B. Attach with aluminum or stainless steel screws to substrate.

C. Bevel-splice joints where plate lengths dictate multiple pieces.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wood blocking.
   2. Wood cants.
   3. Wood nailers.
   4. Wood sheathing.
   5. Plywood backing panels.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product indicated.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Provide dressed lumber, S4S, unless otherwise indicated.
   3. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 DIMENSION LUMBER

A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Framing: No. 2 grade or better as indicated, and the following species:

1. Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; NLGA, WCLIB, or WWPA.

2.4 SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corp.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

B. Provide ¾" thick plywood backing panels at locations for wall-mounted equipment including, but not limited to: grab bars, sinks, toilets, drinking fountains, wall-mounted cabinets, countertops, etc.

END OF SECTION 06100

SECTION 06160 – SHEATHING AND BUILDING WRAP

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wall sheathing.
2. Building wrap.
3. Sheathing joint-and-penetration treatment.
4. Flexible flashing at openings in sheathing.

1.2 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 fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

B. Research/Evaluation Reports: For the following:

1. Fire-retardant-treated plywood.
2. Building wrap.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Plywood.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.

1. Use Exterior type for exterior locations and where indicated.

B. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat all plywood, unless otherwise indicated.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated.

1. For wall sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.4 WEATHER-RESISTANT SHEATHING PAPER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

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

a. Dow Chemical Company (The);
b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
c. Raven Industries Inc.; Rufco-Wrap.
d. Or equal as approved by architect.

3. Water-Vapor Permeance: 28 perms or less.

B. Building-Wrap Tape: Tape recommended by building-wrap manufacturer.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric silicone joint sealant recommended by sheathing manufacturer.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with either APA AFG-01 or ASTM D 3498, that is approved for use indicated by manufacturers of both adhesives and panels.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide."

B. Fastening Methods: Fasten panels as indicated below:

1. Wall Sheathing:
   a. Attach as indicated in structural engineering drawings.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials.

3.4 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.5 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.

3.6 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over weather-resistant building paper at bottom and sides of openings.
3. Lap weather-resistant building paper over flashing at heads of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

3.7 PROTECTION (NOT USED)

END OF SECTION 06160

SECTION 07115 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hot-applied or cold-applied emulsified asphalt dampproofing.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

A. Hot-Applied Asphalt Dampproofing: ASTM D 449, Type I.

B. Cold-Applied, Emulsified-Asphalt Dampproofing:

1. Trowel Coats: ASTM D 1227, Type II, Class 1.
2. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
3. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.2 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

C. Protection Course, Asphalt-Board Type: Premolded, 1/8-inch-thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

A. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

B. Apply dampproofing to footings and foundation walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing.

1. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

3.2 HOT-APPLIED ASPHALT DAMPPROOFING

A. Do not apply hot asphalt when substrate condition causes foaming.

B. Prime masonry and other porous substrates.

C. Apply a uniform coat of hot asphalt by mopping or spraying at not less than 20 lb or 2.5 gal./100 sq. ft.

D. Apply a second coat to below-grade foundation walls as specified above.

3.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, one fibered brush or spray coat at not less than 3 gal./100 sq. ft., or one trowel coat at not less than 4 gal./100 sq. ft.

B. On Backs of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.4 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

END OF SECTION 07115

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Foundation wall insulation.
   2. Concealed building insulation.
   3. Vapor retarders.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Product test reports.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.80 lb/cu. ft. (29 kg/cu. m), with maximum flame-spread and smoke-developed indices of 75 and 450, respectively.

C. Mineral-fiber blanket insulation consisting of fibers manufactured from glass, slag wool, or rock wool:
   1. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
   2. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III, Class A; Category 1, faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face.

2.2 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.3 AUXILIARY INSULATING MATERIALS

A. Protection Board (at foundation walls): Premolded, semirigid asphalt/fiber composition board, 1/2 inch (6 mm) thick, formed under heat and pressure, of standard sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

B. Install perimeter insulation on vertical surfaces by setting units in adhesive.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
   2. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board set in adhesive.

C. Installation of General Building Insulation: Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   1. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant.
   2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
      a. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
   3. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
      a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
      b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm) support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
   5. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
      a. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.

6. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
7. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

D. Installation of Vapor Retarders: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
1. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
2. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
4. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
5. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

END OF SECTION 07210

SECTION 07211 - BLACK-FACED INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

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

B. This section includes labor, material and equipment necessary to provide semi-rigid, black-faced building insulation where shown on the drawings, as specified herein and as needed for a complete and proper installation.

1.2 RELATED WORK

A Division 9, including Finish Painting

B. Division 9, including Ceiling Coverings

1.3 ACOUSTICAL PERFORMANCE REQUIREMENTS

Sound absorbing materials shall be designed to achieve the minimum sound absorption coefficients and minimum NRC ratings specified in Paragraph 2.00 below.

1.4 SUBMITTALS

A. Specifications: Submit Manufacturer's specifications and other data needed to prove compliance with all specified requirements.

B. Installation Instructions: Submit Manufacturer's recommended installation instructions and procedures.

C. Exceptions: Identify all proposed changes, differences and/or discrepancies, including verbiage, terms and definitions between Contract Documents and submittals.

D. Samples for Initial Color Selection: Submit 12" x 12" samples of coverings for sound absorbing finishes before ordering such material. Where finishes involve normal color variations, include sample sets showing the full range of variations expected.

E. Samples for Verification Purposes: Submit 12" x 12" samples of the entire sound absorbing finish assembly, including samples of installation devices.

F. Acoustical Test Reports: Submit complete acoustical test reports showing that the proposed product has been tested in accordance with latest editions of ASTM C 423 and ASTM E 795 and has met or exceeded the specified Noise Reduction Coefficient (NRC) rating.

1.5 QUALITY ASSURANCE

A. Manufacturer's Experience: The Manufacturer shall have successful experience in sound absorbing finish fabrication and installation, including no less than five years experience in fabrication and installation of materials identical to those required in this work.

B. Acoustical Performance: Sound absorption tests and calculations shall be conducted in

accordance with the latest editions of ASTM C 423, *Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method* and ASTM E 795, *Standard Practices for Mounting Specimens during Sound Absorption Tests.* The test shall be conducted by a laboratory that is accredited for specific acoustical testing under the National Voluntary Laboratory Accreditation Program (NVLAP). Test reports shall include a description of the tested material sample, size of the sample, test setup, measurement instrumentation, test procedure, tabulated octave band absorption coefficients and resulting NRC ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect products during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of manufacturer's instructions. Package products at factory prior to shipping using manufacturer's standard method.

B. Identify each product with individual room numbers which correlate with designation system used on shop drawings using temporary, removable or concealed markings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Johns Manville, Owens Corning, or equal.

2.2 MATERIALS AND INSTALLATION

A. General Product Description: Semi-Rigid, Black-Faced Glass Fiber Building Insulation (ACT-5, ACT-6, AWF-4 in Finish Schedule).

B. Thickness and Application: 2"-thick on ceiling surfaces as scheduled and shown in project drawings.

C. Minimum NRC Ratings: 2”: 0.95

D. Minimum Glass Fiber Density: 2 pounds per cubic foot.

E. Acceptable Products: Johns Manville “Theatre-SHIELD Plus” TS-202 and TS-201, Owens-Corning “SelectSound” board or blanket, or equivalent

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

Do not begin installation until spaces to receive acoustical treatment are enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy.

3.2 METHOD OF ATTACHMENT

The method of attachment shall be coordinated with Architect. Options are as follows:

A. Impaling pins: Metal or plastic spindle with base plate approximately 2" square or round for adhesive application. Provide spindles with retainer friction washers or washers with spindle caps. Spindle length as appropriate for thickness of insulation.

B. Adhesives: As recommended and approved by material manufacturer for the substrate to which mechanical fasteners or material is to be secured.

3.3 INSTALLATION

Adhere impaling pins to substrate with recommended and approved adhesive. Locate fasteners not more than 3" from each edge or corner of acoustical unit and not more than 12" on center. Locate additional fasteners in the field of each acoustical unit not more than 24" on center. Impale acoustical unit onto spindle with edges tightly butted. Install retainer friction washers or washers with spindle caps snugly to acoustical unit without over compressing the unit. Touch up locally with flat black paint to conceal spindle caps and other irregularities.

END OF SECTION 07211

SECTION 07412 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Metal-faced wall panels.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

   1. Water Leakage: As defined according to AAMA 501.1.

D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

   1. Wind Loads: Determine loads based on the following minimum design wind pressures:

      a. Uniform pressure of 35 lbf/sq. ft., acting inward or outward.
      b. Uniform pressure as indicated on Drawings.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing **the full range of colors** available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall and Soffit Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.

E. Maintenance Data: For metal wall panels to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of metal-faced composite wall panels.

1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.

B. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Two years** from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: **20 years** from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Weathertight Warranty Period: **10 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alclad alloy 3003, 3004, or 3105 for painted finishes, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.
2. Exposed Finishes: Apply the following coating, as specified or indicated on Drawings.
   1) Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.

2.2 SUBSTRATE BOARDS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: Regular, 1/2 inch (13 mm).
2. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by Georgia-Pacific Corporation.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.

1. Fasteners for Wall Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 METAL WALL AND SOFFIT PANELS

A. General: Provide factory-formed metal wall & soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Metal Wall & Soffit Panels.

1. Color & finish: To be selected **from manufacturer's full range of colors**. Silver-metallic finish desired to match clear anodized aluminum elements.
2. Sealant: Factory applied within interlocking joint.

3. Material: Aluminum sheet metal; 1/16" th., minimum.

2.5 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.6 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal recommended by metal wall panel manufacturer.

PART 3 - EXECUTION

3.1 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

B. Fasteners:
1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

1. Coat back side of aluminum wall panels with bituminous coating where wall panels will contact wood, ferrous metal, or cementitious construction.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.

3.2 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.3 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

A. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (300 Pa).

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

D. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 07412

SECTION 07531 - EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mechanically fastened membrane roofing system.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each product included in membrane roofing system.

D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Source Limitations: Obtain components for membrane roofing system from same manufacturer as roofing membrane.

C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

D. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Warranty Period: **15 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D 4637, Type II, scrim or fabric internally reinforced uniform, flexible sheet made from EPDM, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

a. Carlisle SynTec Incorporated.
b. Celotex Corporation.
c. ERSystems.
d. Firestone Building Products Company.
e. GenFlex Roofing Systems.
f. Johns Manville International, Inc.
g. Protective Coatings, Inc.
h. Roofing Products International, Inc.
i. Stafast Roofing Products.
j. Versico Inc.

2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White-on-black.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide lap sealant, water cutoff mastic, metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) thick, seal coated.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. **Minimum 3" cover**.

B. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal-coated.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

B. Provide flexible walkways from existing roof access locations to all new roof drains, roof penetrations and roof-mounted equipment locations.

PART 3 - EXECUTION

3.1 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.2 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 3 inches (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

F. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck.

3.3 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten roofing membrane securely at terminations and perimeter of roofing.

E. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's

written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

F. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

G. Through-Membrane Attachment: Secure roofing membrane using fastening plates or battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous strip.

3.4 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.5 WALKWAY INSTALLATION

A. Flexible Walkways: **Install walkway products from existing roof access points to all new roof drains, roof penetrations and roof mounted equipment**. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

END OF SECTION 07531

SECTION 07620 – SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Provide all labor, equipment, and materials; fabricate and install the following.

1. Edge strip and flashing.
2. Counterflashings over bituminous base flashing.
3. Counterflashings for roof accessories.
4. Counterflashings at roof mounted equipment and vent stacks.
5. Base flashing coverings.
6. Coping cap at parapets.
7. Counterflashings at walls and penetrations.
8. Other components.

1.2 SUBMITTALS

A. Manufacturer's Product Data

1. Submit color chart prior to material ordering and/or fabrication. Colors for parapet coping will be selected from the **manufacturer's full range**. Silver-metallic finish is desired to match clear anodized aluminum elements.

1.3 QUALITY ASSURANCE

A. Reference Standards

1. Comply with details and recommendations of SMACNA Manual for workmanship, methods of joining, anchorage, provisions for expansion, etc.

1.4 JOB CONDITIONS

A. Protection:

1. Provide protection or avoid traffic on completed roof surfaces.
2. Do not overload roof with stored materials.
3. **Support no roof-mounted equipment directly on the roofing system.**

B. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place an approved prior to installation of roofing.

1.8 WARRANTIES

A. Manufacturer's Warranty

1. Pre-finished metal material shall require a written **20-year** non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to the Owner.

B. Contractor's Warranty

1. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of **two years** from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

PART 2 PRODUCTS

2.1 MATERIALS

A. Miscellaneous Metals and Flashings:

1. Zinc-Coated Steel Sheet: ASTM A526, 0.20% copper, 26 gage (0.0179"); designation G90 hot-dip galvanized, mill phosphatized.
2. Stainless Steel Sheet: Type 302/304, ASTM A167, 28 gage, (0.015"), annealed except dead soft where fully concealed by other work, 2D (dull) finish.
3. Lead-Coated Copper Sheet: ASTM B101. Type I, Class A (12-15 1 lb. of lead coating per 100 sq. ft.), 17.1 oz. (0.022").
5. Zinc Alloy Sheet: Zinc with 0.6% copper and 0.14% titanium; 0.27" thick (21 gauge); standard (soft) temper, mil finish.

2.2 RELATED MATERIALS

A. Metal Primer: Zinc chromate type.

B. Underlayment: ASTM D2178, No15 asphalt saturated roofing felt.

C. Slip Sheet: Rosin sized building paper.

D. Fasteners:

1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
2. Fastening shall conform to Factory Mutual 1-90 requirements or as stated on section details, whichever is more stringent.

J. Termination Bars:

1. Shall be aluminum unless otherwise recommended by membrane manufacturers.
2. Material shall be .125" x 1" (minimum) aluminum conforming to ASTM B-221, mill finish. Bar shall have caulk cup as required.

PART 3 EXECUTION

3.1 PROTECTION

A. Protect contact areas of dissimilar metals with heavy asphalt or other approved coating, specifically made to stop electrolytic action.

3.2 GENERAL

A. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction.

B. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, Factory Mutual I-90 wind uplift specifications and/or manufacturer's recommendations whichever is of the highest standard.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

D. Metal fascia and copings shall be secured to wood nailers at the bottom edge with a continuous cleat. Cleats shall be at least one gauge heavier than the metal it secures.

3.3 SHOP FABRICATED SHEET METAL

A. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

C. Hem exposed edges.

D. Angle bottom edges of exposed vertical surfaces to form drip.

E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.

F. Install sheet metal to comply with Architectural Sheet Metal manual, Sheet Metal and Air Conditioning Contractor's National Associations, Inc.

3.5 FLASHING MEMBRANE INSTALLATION

A. METAL EDGE DETAIL

1. Install continuous cleat fasten 6" O.C. Fasten flange to wood nailer every 6" staggered.
2. Install new metal edge hooked to continuous cleat.
3. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

B. COPING CAP DETAIL

1. Accessories: Joint covers, seam sealant, seam tape, caulking, fasteners, and other accessories shall be included.
2. Install continuous cleats on outside of wall and fasten 6" O.C. Fasten coping cap on inside of wall 6" O.C.
3. Install new coping cap hooked to continuous cleat.
4. Metal edge pieces shall be overlapped a minimum of 2", or butted at ends with internal drainage plate or sealed batten cover.
5. **Provide pre-finished coping in sizes and profiles indicated on drawings. Color TO BE SELECTED FROM MANUFACTURER'S FULL RANGE.**

C. SURFACE MOUNTED COUNTERFLASHING

1. Counterflashing shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match counterflashing.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Apply butyl tape to wall behind flashing. Secure termination bar through flashing butyl tape and into wall.
4. Secure new counterflashing set on a butyl tape above flashing 8" O.C., caulk top of counterflashing.
5. Adjacent counterflashing pieces shall overlap a minimum of 1/2".

D. EQUIPMENT SUPPORT

1. Covers shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install pre-manufactured expansion joint cover. Fasten sides 24" O.C. with fasteners and neoprene washers. All joint cover laps will have butyl tape in between metal covers.
4. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

E. CURB DETAIL/AIR HANDLING STATION

1. Counterflashing shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install pre-manufactured expansion joint cover. Fasten sides 8" O.C. with fasteners and neoprene washers.
4. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

F. ROOF DRAIN

1. Prime lead/copper at a rate of 100 sq. feet per gallon and allow to dry.
2. Set lead/copper flashing (30" square minimum) in a 1/4" bed of mastic.
3. Install clamping ring and strainer assure all plies are under the clamping ring.

G. PLUMBING STACK

1. Prime flange and sleeve at a rate of 100 square feet per gallon and allow to dry.
2. Install properly sized sleeves in a 1/4" bed of elastomeric sealant.
3. Turn sleeve a minimum of 1" down inside of stack.
4. Caulk intersection of the membrane and flange with elastomeric sealant.

H. HEAT STACK

1. Prime flange and sleeve at a rate of 100 square feet per gallon and allow to dry.
2. Install properly sized sleeves in a 1/4" bed of elastomeric sealant.
3. Install new collar over cape. Weld collar or install stainless steel draw band.
4. Caulk intersection of the membrane and flange with elastomeric sealant.

END OF SECTION

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel doors.
2. Steel door frames.
3. Sidelight frames

1.2 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.3 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.2 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.3 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.053-inch- (1.3-mm-) thick steel sheet for:
   1. Level 2 steel doors.
   2. Wood doors, where indicated.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

E. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.

   1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.4 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:

1. Cold-rolled steel sheet, unless otherwise indicated.
2. Metallic-coated steel sheet where indicated.

D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Single-Acting, Door-Edge Profile: Beveled edge.

H. Double-Acting, Door-Edge Profile: Round vertical edges with 2-1/8-inch (54-mm) radius.

I. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

J. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

K. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

L. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints, unless otherwise indicated.
2. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
3. For interior applications, fabricate knock-down frames with mitered or coped corners, for field assembly.
4. Provide welded frames with temporary spreader bars.

M. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

N. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

O. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors. Locate stops at room sides of frames, not hall or corridor sides.

2.5 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid-core doors as follows:

1. Doors with wood-veneer faces and factory finishing.
2. Factory fitting wood doors to frames and factory machining for hardware.

1.2 SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details; location and extent of hardware blocking; mortises, holes, and cutouts, requirements for veneer matching, factory finishing and other pertinent data.

C. Samples: For each face material and finish.

1.3 QUALITY ASSURANCE

A. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION

A. Doors for Transparent Finish:

1. Grade: Custom Grade A faces.
2. Species and Cut: Eucalyptus – quarter figured.
3. Match between Veneer Leaves: Slip match.
4. Assembly of Veneer Leaves on Door Faces: Center balance match.
5. Pair and Set Match: Provide for doors hung in same opening.

B. Interior Veneer-Faced Solid-Core Doors:

1. Core: Particleboard or glued block.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
3. Construction: Seven plies, either bonded or nonbonded construction.

C. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

2.2 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated. 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.

2.3 FACTORY FINISHING

A. General: Finish doors at factory that are indicated to receive transparent finish.

B. Grade: Custom.

C. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-4 conversion varnish.

D. Staining: to be selected by Architect.

E. Effect: Open-grain finish.

F. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

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.

END OF SECTION 08211

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.
3. Exterior and interior aluminum door frames.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferred to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units to function properly.

B. Structural Loads: as indicated on drawings.

C. Structural-Test Performance: Systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

D. Temperature Change (Range): Systems accommodate 120 deg F, ambient; 180 deg F, material surfaces.

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of systems of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration Under Static Pressure: Systems do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Condensation Resistance: Fixed glazing and framing areas of systems have condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

H. Average Thermal Conductance: Fixed glazing and framing areas of systems have average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples: For each exposed finish.

D. Product test reports.

E. Field quality-control test and inspection reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to manufacturer and capable of preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.5 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.

2. Warranty Period: **Five years** from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: **20 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

2.2 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.3 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.4 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.5 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

B. Cylinder Keying: Master key system. Coordinate keying system with Snow College.

C. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

D. Weather Stripping: Manufacturer's standard replaceable components.

E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

F. Silencers: BHMA A156.16, Grade 1.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: Class I, clear anodic coating complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Fit joints to produce hairline joints free of burrs and distortion.
2. Rigidly secure nonmovement joints.
3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
4. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Install components plumb and true in alignment with established lines and grades, without warp or rack.

E. Install glazing as specified in Division 8 Section "Glazing."

F. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

G. Install perimeter joint sealants to produce weathertight installation.

H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08411

SECTION 08712 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.

1.2 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Warranty: Special warranty specified in this Section.

1. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware, and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. 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 perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:
a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

1.5 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 **twelve** 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 same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with Snow College campus standards. Bob Oliver and Snow College Facilities personnel will review all proposed hardware for compliance with standards.

B. Components of door hardware for each door location are listed on the architectural drawings.

C. Panic devices and locks to comply with Snow College standards and be approved by the State Fire Marshal.

2.2 FABRICATION

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

1. Manufacturer's identification is 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. 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, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.3 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

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.

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 ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 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. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, and door hardware.

3.5 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 that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION 08712

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed curtain walls.
4. Glazed entrances.
5. Storefront framing.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Minimum glass thickness, nominally, of lites in exterior walls is 6 mm, except where otherwise noted.
2. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: 12-inch-square, for each type of glass product indicated, other than monolithic clear float glass.

C. Glazing Schedule: Use same designations indicated on Drawings.

D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.4 QUALITY ASSURANCE

A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups to illustrate the finished product according to one of the glazed openings in the Documents **(required for Alternate No. 3 only)**.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: **10 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal.
4. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.2 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: Black.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants:

a. Type and Grade: S (single component) and NS (nonsag).
b. Class: 100/50.
c. Use Related to Exposure: NT (nontraffic).
d. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2.4 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.6 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear); Kind HS (heat-strengthened) float glass.

1. Thickness: ¼" (6.0 mm).
2. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.

B. Uncoated Clear Float-Glass Units: Class 1 (clear); fully tempered; sandblasted on back (second) surface. ***(THIS ITEM PER ALTERNATE NO.3)***
1. Thickness: ½"
2. Where sandblast finish indicated, provide sandblasted finish at back surface closest to exterior wall. Apply sealer to sandblasted surface after installation.
3. Provide bolt holes in glass and neoprene spacer for mounting.
4. Refer to architectural drawings for clear and sandblasted locations as well as mounting details.

2.7 INSULATING-GLASS UNITS

A. Solar-Control Low-E Insulating-Glass Units:

1. Overall Unit Thickness and Thickness of Each Lite: 1" and ¼" (6mm).
2. Interspace Content: Air.
3. Outdoor Lite: Class 1 (clear) float glass.
   a. Kind HS (heat strengthened).

4. Indoor Lite: Class 1 (clear) float glass.

   a. Kind HS (heat strengthened).

5. Low-E Coating: Pyrolytic on third surface.

6. Visible Light Transmittance: 70 percent minimum.
7. Winter Nighttime U-Factor: .29 maximum.
8. Summer Daytime U-Factor: .28 maximum.
9. Solar Shading Coefficient: .43 maximum.

B. Solar-Control Low-E Insulated Glass Units: (sandblasted)

1. Overall Unit Thickness and Thickness of Each Lite: 1" and ¼" (6mm).
2. Interspace Content: Air.
3. Outdoor Lite: Class 1 (clear) float glass.
   a. Kind HS (heat strengthened).

4. Indoor Lite: Class 1 (clear) float glass.

   a. Kind HS (heat strengthened).

5. Low-E Coating: Pyrolytic on third surface.

6. Sandblasted surface: provide sandblasting on second surface to achieve 50% density.

7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: .29 maximum.
9. Summer Daytime U-Factor: .28 maximum.
10. Solar Shading Coefficient: .43 maximum.

PART 3 - EXECUTION

3.1 GLAZING

A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
6. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
7. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
3. Apply heel bead of elastomeric sealant.
4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
5. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
3. Install gaskets so they protrude past face of glazing stops.

3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08800

SECTION 08830 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Annealed monolithic glass mirrors.

1.2 SUBMITTALS

A. Product Data: For mirror hardware and mastic.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.3 QUALITY ASSURANCE

A. Glazing Publications: Comply with GANA's "Glazing Manual" and GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors" unless more stringent requirements are indicated

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated in second subparagraph below.

1. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
2. Warranty Period: **10 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRROR MATERIALS

A. Clear Glass Mirrors: ASTM C 1503, Mirror Select Quality.

1. Nominal Thickness: min. 5.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.

1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install with mastic and mirror hardware.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
2. For mirror hardware in the form of continuous J-channels at bottom, provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long.
3. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

D. Protect mirrors from breakage and contaminating substances resulting from construction operations.

E. Do not permit edges of mirrors to be exposed to standing water.

F. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 08830

SECTION 08911 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes conventionally glazed aluminum curtain walls installed as unitized systems.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferred to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

C. Structural-Test Performance: Systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Duration: As required by design wind velocity but not less than 60 seconds.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Temperature Change (Range): Systems accommodate 120 deg F, ambient; 180 deg F, material surfaces.

F. Air Infiltration: For systems, maximum air leakage of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration Under Static Pressure: Systems do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 10 lbf/sq. ft. (479 Pa).

H. Condensation Resistance: For systems, condensation-resistance factor (CRF) of not less than 55 when tested according to AAMA 1503.

I. Average Thermal Conductance: For systems, average U-factor of not more than 0.66 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain-wall systems.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to manufacturer and capable of preparing data for glazed aluminum curtain-wall systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups to illustrate finished product of the window system proposed as part of Alternate No. 3.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Advanced Building Systems, Inc.
2. Arch Aluminum & Glass Co., Inc.
3. CMI Architectural Products, Inc.
4. EFCO Corporation.
5. Kawneer.
6. Tubelite, Inc.
7. United States Aluminum.
8. Vistawall Architectural Products.
9. Wausau Window and Wall Systems.

2.2 FRAMING SYSTEMS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads.
4. Finish exposed portions to match framing system.

D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

2.3 FABRICATION

A. Form aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Sharp profiles, straight and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
6. Provisions for reglazing from exterior.

C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.4 ALUMINUM FINISHES

A. Clear Anodic Finish: Class I, clear anodic coating complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Fit joints to produce hairline joints free of burrs and distortion.
2. Rigidly secure non-movement joints.
3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
4. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
5. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Erection Tolerances: Install glazed aluminum curtain-wall systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
2. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
3. Alignment:

   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (13 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08911

SECTION 08912 - STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

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 types of structural-sealant-glazed curtain walls with aluminum framing systems:

1. Field-glazed two-sided systems.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide structural-sealant-glazed curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. All structural loads, testing, infiltration, deflection and other performance criteria shall be not less than those established for the Glazed Aluminum Curtain Wall Systems per Section 08911.

B. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by curtain-wall systems without failing adhesively or cohesively. Provide sealant that fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

C. Structural-Sealant Joints: Designed to produce tensile or shear stress in structural-sealant joints of less than 20 psi (138 kPa).

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of structural-sealant-glazed curtain-wall systems.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Field quality-control test and inspection reports.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Structural-Sealant Glazing: Comply with recommendations in ASTM C 1401, "Guide for Structural Sealant Glazing."

D. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

E. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup as part of system outlined in Alternate No. 3 and Section 08911.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for structural-sealant-glazed curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating structural-sealant-glazed curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of structural-sealant-glazed curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: provide all SSG curtain wall system components from same manufacturer as other curtain wall products described in the Construction Documents. Refer to Section 08911

2.2 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and system performance requirements.

C. Glazing Sealants: As recommended by manufacturer for joint type and as follows:

1. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in curtain-wall systems indicated.

a. Color: Black.
b. Type: Manufacturer's standard single or two component.
c. Minimum Tensile Strength: 100 psi (690 kPa).
d. Modulus of Elasticity: As required by structural-sealant-glazed curtain-wall system design to meet performance requirements.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by structural- and weatherseal-sealant and curtain-wall manufacturers for this use.

a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
b. Color: Matching structural sealant.

2.3 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finishes to match system outlined in Section 08911.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Coordinate with Glazed Aluminum Curtain Wall system; Section 08911.

END OF SECTION 08912

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Non-load-bearing steel framing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 STEEL FRAMING

A. Steel Framing, General: Comply with ASTM C 754 for conditions indicated.

B. Suspended Ceiling and Soffit Framing:

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
3. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, and in depth indicated.
4. Furring Channels (Furring Members):

a. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange, 3/4 inch deep.
b. Steel Studs: ASTM C 645, in depth indicated.

1) Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

1) Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

C. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products:

a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
b. Chicago Metallic Corporation; Drywall Furring 640, Drywall Furring 660 System.
c. USG Interiors, Inc.; Drywall Suspension System.

D. Partition and Soffit Framing:

1. Steel Studs and Runners: ASTM C 645, in depth indicated.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm), 0.027 inch (0.7 mm) and 0.0312 inch (0.79 mm) as required by span or length according to manufacturers' recomendations.

2. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch-deep flanges.

3. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange, and in depth indicated.

a. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch-thick, galvanized steel.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, in depth indicated.

a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

5. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, and in depth indicated.

a. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
b. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

6. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
7. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.3 PANEL PRODUCTS

A. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type: In thickness indicated and with long edges tapered.
2. Type X: In thickness indicated and with long edges tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use drying-type, all-purpose compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

C. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

PART 3 - EXECUTION

3.1 NON-LOAD-BEARING STEEL FRAMING INSTALLATION

A. General: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Suspended Ceiling and Soffit Framing:

1. Suspend ceiling hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Attach hangers to structural members. Do not support ceilings from or attach hangers to permanent metal forms, steel deck tabs, steel roof decks, ducts, pipes, or conduit.
4. Screw furring to wood framing.
5. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
6. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

C. Partition and Soffit Framing:

1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.
2. 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.
3. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

4. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

D. Z-Furring Members: Erect insulation vertically and hold in place with Z-furring members.

E. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section "Building Insulation."

3.2 PANEL PRODUCT INSTALLATION

A. Gypsum Board: Comply with ASTM C 840 and GA-216.

1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.
3. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
4. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.

5. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
6. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.3 FINISHING

A. Installing Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Finishing Gypsum Board Panels: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

1. Prefill open joints, beveled edges and damaged surface areas.
2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
3. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

C. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
2. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.

END OF SECTION 09260

SECTION 09310 - CERAMIC TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Glazed floor and wall tile.
   2. Crack-suppression membrane for thin-set tile installations.
   3. Cementitious backer units installed as part of tile installations.
   4. Metal edge strips installed as part of tile installations.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints.

C. Samples:
   1. Each type, composition, color, and finish of tile.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. Manufacturers, Colors and Sizes:
   1. As indicated on drawings.

B. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

2.2 ACCESSORY MATERIALS

A. Crack-Suppression Membranes for Thin-Set Tile Installations: Manufacturer's standard product that complies with ANSI A118.10, selected from the following:
   1. Fabric-Reinforced, Fluid-Applied Product: Liquid-latex rubber with fabric reinforcement.
      a. Available Products:
         1) Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.
         2) LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
         3) MAPEI Corporation; PRP M19.
         4) Summitville Tiles, Inc.; S-9000.

2. Unreinforced, Fluid-Applied Product: Liquid-latex rubber.
   a. Available Products:
      1) Boiardi Products Corporation; Elastiment 324.
      2) Custom Building Products; LevelQuick Waterproofing and Anti-Fracture Membrane.
      3) Jamo Inc.; Waterproof.
      4) Latex-Portland Cement Product: Flexible mortar with acrylic-latex additive.
   b. Available Products:
      1)Boiardi Products Corporation; Elastiment 323.
      1) MAPEI Corporation; PRP 315.
      2) Southern Grouts & Mortars, Inc.; Southcrete 1100.
      3) TEC Specialty Products Inc.; TA-324, Triple Flex.

3. Urethane Waterproofing and Tile-Setting Adhesive: One-part liquid-applied urethane.
   a. Available Products:
      1) Bostik; Hydroment Ultra-Set.
      2) Southern Grouts & Mortars, Inc.; Deck-Seal 1000.

2.3 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:
   1. Atlas Minerals & Chemicals, Inc.
   2. Bostik.
   3. C-Cure.
   4. DAP, Inc.
   5. LATICRETE International Inc.
   6. MAPEI Corporation.
   7. TEC Specialty Products Inc.

B. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
   1. Prepackaged dry-mortar mix combined with liquid-latex additive.
   2. For wall applications, provide nonsagging mortar.

D. Water-Cleanable, Tile-Setting Epoxy Adhesive: ANSI A118.3.

E. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated.

F. Cementitious Backer Units: ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.
   1. Thickness: 1/2 inch (12.7 mm).
   2. Available Products:
      a. Custom Building Products; Wonderboard.
      b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      c. USG Corporation; DUROCK Cement Board.

G. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials.

H. Metal Edge Strips: Angle or L-shape, clear anodized aluminum or stainless steel; ASTM A 666, 300 Series exposed-edge material.

I. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions.

C. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

E. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Grout tile to comply with requirements of ANSI A108.10, unless otherwise indicated.

H. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11.

I. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
   1. Tile floors in wet areas.
   2. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   3. Tile floors composed of rib-backed tiles.

J. Install tile on floors with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
   2. Quarry Tile: 1/4 inch (6.35 mm).
   3. Paver Tile: 1/4 inch (6.35 mm).

K. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile. See details in drawings.

L. Install tile on walls with the following joint widths:
   1. All Wall Tile: 1/16 inch (1.6 mm).

M. Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

END OF SECTION 09310

SECTION 09512 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each acoustical panel, for each exposed suspension system member, trim piece and for each texture required.

1.3 QUALITY ASSURANCE

A. Seismic Standard: Comply with the following:

1. ASTM E 580.
2. CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
3. International Building Code 2003, section 1621

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   1. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic struts and seismic clips.

2.2 ACOUSTICAL PANELS

A. Products: As indicated on Drawings.

B. Color: As indicated on Drawings

C. Size: 24 by 24 inches (610 by 610 mm).

2.3 METAL SUSPENSION SYSTEM

A. Products: As indicated on drawings.

B. Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with 9/16-inch- (15-mm-) wide metal caps on flanges.
   1. Structural Classification: Heavy-duty system.
   2. End Condition of Cross Runners: Butt-edge type.
   3. Cap Material: Steel or aluminum cold-rolled sheet.
   4. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. **See General Structural notes on sheet SG002 section V, paragraph I.10 for requirements for attaching hangers to steel roof deck.**

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate with concealed fasteners at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 09512

SECTION 09640 - WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the Dance Studio wood floors.

1. Sprung hardwood flooring.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data including manufacturer's detailed technical product data and installation instructions for each type of wood flooring. Include instructions for handling, storage, installation, and dimensions of individual components, profiles, edge detail, finishing, protection, and maintenance.

C. Samples consisting of sets of range samples for each type of wood flooring.

1. Include unfinished samples of flooring material and finished samples representing site finishing.
2. Accessories: Include minimum 6-inch (150 mm) long samples of each type of required accessory item such as wood or metal feature strips, reducer strips, baseboard, trim, molding, and nosings.

D. Shop drawings showing layout of wood flooring, including plans, sections, details of anchorage and attachments to other units of Work, and conditions requiring feature strips, baseboard, trim, molding, nosings, or other accessories.

1. Show spacing of pads and sleepers.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has specialized in installing types of wood flooring similar to those required for this Project.

B. Source Quality Control: Obtain flooring of each type from a single manufacturer or source to ensure a match of quality, color, pattern, and texture.

C. General Standards:

1. Plywood: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood Panels. Provide fire-retardant treated wood where indicated.
2. Tempered Hardboard: Comply with requirements of ANSI/AHA A135.4.
3. Maple Flooring: Comply with NOFMA grading rules for species, grade and cut. Provide NOFMA grade stamp on each bundle or piece.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.

C. Store wood flooring materials in a dry, warm, well-ventilated, weathertight location.

D. Move wood flooring into spaces where it will be installed, at least seven days before installation.

1.6 PROJECT CONDITIONS

A. Moisture Content: At time of delivery, average moisture content of wood flooring to be 6 to 9 percent, with a maximum of 12 percent for any one piece and not more than 5 percent outside of given average range.

B. Conditioning: Do not install wood flooring until spaces are enclosed and at approximate humidity condition planned for occupancy. Condition wood for 5 days before start of installation by placing in spaces to receive flooring and maintaining ambient temperature between 65 and 75 deg F (18 and 24 deg C) before, during, and after installation. Open sealed packages of wood flooring to permit natural adjustment of moisture content and allow flooring to acclimate to the room conditions.

1.7 WARRANTY

A. Warranty: Submit a written warranty executed by Manufacturer, Installer, and Contractor, agreeing to repair or replace wood flooring that fails in materials or workmanship within the specified warranty period. Failures include, but are not limited to:

1. Buckling, warping, squeaking, and loosening.
2. Excessive open joints or cracks.
3. Deterioration of finishes beyond normal wear.

B. Warranty Period: 3 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 EXTRA MATERIAL

A. Deliver extra material to Owner. Before installation begins, furnish not less than 2.0 percent of the quantity of each type wood flooring installed on the Project, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.1 WOOD FLOORING SYSTEM

A. Subfloor Assembly – Dance Studio

1. MINIMUM:

   a) Sheeting: One layer of 1-1/8" special grade T&G plywood with no core voids.
   b) Sleepers: Nominal 2x3 wood sleepers on 16" centers.
   c) Resilient Supports: 3/8"-thick, minimum 3"x3", 40 durometer waffled neoprene pads on maximum 12" centers beneath sleepers.

2. FLOORING:

   a) Nominal 3/4" x 2 ¼" hard maple, clear, plain sawn, with T&G edges and matched ends. Channeled backs, random lengths.

2.4 ACCESSORY MATERIALS

A. Fasteners: As recommended by manufacturer, but not less than that recommended in NOFMA "Installation Manual."
B. Wood Trim: Where indicated to match wood flooring. Except as otherwise indicated, provide wood stripping, reducer strips, saddles, thresholds, and other wood accessories indicated in or adjacent to wood flooring of same material as flooring and as noted and detailed.
C. Threshold: Wood threshold molding, tapered each side and routed at bottom of one side to accommodate finish wood flooring. Provide in species and finish to match wood flooring.
D. Reducer Strip: 2-inch (51-mm) wide tapered reducer strip in thickness, species and finish to match wood flooring.
E. Cork expansion strip: Composition cork strip complying with FS HH-C-576, Type I-B, Class
F. Wood Trim: In same specfied and grade as wood flooring, unless otherwise indicated.

2.5 FINISH

A. Finish floor w/ a premium, oil-modified floor finish formulated for interior use on commercial wood floors.
B. MANUF.: Provide Bona X Woodline Polyurethane #90050 Satin finish (or equal as approved by architect). Install and apply per manufacturer's recommendation for dance floors. Apply in number of coats recommended by finish manufacturer for application indicated, but not less than three.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates where wood flooring will be installed and conditions under which work will be performed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION

A. Where direct application of wood flooring to concrete substrate is indicated, test for dryness before proceeding with installation. Check levelness of concrete substrate to ensure not more than 1/4-inch (6-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge. Grind down high spots or fill in low spots to correct improper conditions.

B. Apply moisture barrier over concrete substrate or subfloor as recommended by flooring manufacturer.

3.3 INSTALLATION

A. Pattern: Comply with pattern or direction of pattern for laying wood flooring as indicated or, if not indicated, as directed by Architect.

B. Expansion Space: Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch (19 mm) unless otherwise indicated on drawings. Unless fully concealed by trim, fill expansion space with flush cork expansion strip.

C. Subfloor Installation:

1. Install polyethylene film vapor retarder over concrete slab surface. Cap adjoining edges 4 to 6 inches, and seal. Turn vapor retarder up wall surfaces behind base, or minimum of 6 inches.
2. Install resilient pads on 2x3 sleepers and lay them in continuous lines at spacing indicated. Do not fasten sleepers to slab.
3. Lay out plywood panels with long dimension perpendicular to the long dimension of area they are in. Align ends of panels to fall over sleepers. Anchor panels to sleepers as indicated on drawings. Stagger joints of adjacent panels. Leave ¾” inch space at walls and ¼” inch to ½” inch between panels. Cut plywood to fit within 1/8” inch near and around door jambs and other construction where finished trim will not be reused.

F. HARDWOOD FLOOR INSTALLATION

1. Installation Procedures: Comply with flooring manufacturer’s written instructions, but not less than recommendations in NOFMA’s “Installation Hardwood Flooring”, as applicable to flooring type.
2. Expansion Space: Provide expansion space at walls and other obstructions and terminations of flooring of not lass than ¾ inch (19mm), unless otherwise indicated on Drawings.

a. Unless fully concealed by trim, fill expansion space with flush cork expansion strip.

3. Blind nail flooring to substrate according to NOFMA's written recommendations.
4. Accessories: Nail baseboard to wall and nail shoe molding or other trim to baseboard; do not nail to flooring.

3.4 SANDING AND FINISHING

A. Machine-sand hardwood flooring to remove offsets, ridges, cups, and a sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

B. Apply filler according to manufacturer's written instructions.

1. Fill open-grained hardwood.
2. Fill and repair seams and defects.

C. Apply stain to match approved Sample if required.

D. Apply sealer according to finish manufacturer's written instruction.

E. Apply floor finish according to finish manufacturer's written instructions. Apply in number of coats recommended by finish manufacturer for application indicated, but not less than three.

F. For water based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

3.5 PROTECTION

A. Protect installed unfinished and prefinished wood flooring during remainder of construction period with heavy kraft paper or other suitable covering to prevent damage or deterioration. Do not use plastic sheet or film that could cause condensation.

B. Do not cover site-finished floors with kraft paper, rugs or any other material until finish reaches full cure, not less than 7 days.

END OF SECTION 09550

SECTION 09651 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: Full-size units of each color and pattern of resilient floor tile required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

   1. 48 hours before installation, during installation and 48 hours after installation.

B. After post-installation period, maintain temperatures within range recommended by manufacturer.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.

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

B. Color and Pattern: as indicated on Drawings.

C. Thickness: 0.125 inch (3.2 mm).

D. Size: 12 by 12 inches (305 by 305 mm).

E. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, etc.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

H. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09651

SECTION 09680 - CARPET

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes tufted carpet.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each carpet and exposed accessory and for each color and pattern required.

C. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by manufacturer.

1.5 WARRANTY

A. Carpet Warranty: Manufacturer's standard form in which manufacturer agrees to replace carpet that does not comply with requirements or that fails within **10 years** from date of Substantial Completion. Warranty does not include deterioration or failure of carpet from unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

PART 2 - PRODUCTS

2.1 CARPET

A. Products: Subject to compliance with requirements, provide the following:

1. Product as indicated on Drawings in colors, patterns and performance characteristics associated with each Product.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with CRI 104, Section 8, "Direct Glue-Down."

B. Maintain uniformity of carpet direction and lay of pile. At doorways, locate seams as indicated on drawings. Bind or seal cut edges as recommended by carpet manufacturer.

C. Install pattern parallel to walls and borders, or as indicated on drawings.

END OF SECTION 09680

SECTION 10101 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Markerboards.

1.2 SUBMITTALS

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

1.3 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: 40 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
   1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Melamine: Thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

C. Particleboard: ANSI A208.1, Grade 1-M-1.

D. Fiberboard: ANSI A208.2, Grade MD.

E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

F. High-Pressure Plastic Laminate: NEMA LD 3.

G. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.
   1. Particleboard Core: 3/8 inch thick; with 0.005-inch-thick, aluminum foil backing.

2.3 MARKERBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous, extruded aluminum, solid type with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
   2. End Stops: Located at each end of map rail.
   3. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.

2.4 FABRICATION

A. Fabricate visual display surfaces to sizes indicated on Drawings.

B. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

C. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

E. Aluminum Anodic Finish: Class II, clear anodic coating complying with AAMA 611

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

B. Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.

D. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10101

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Warm-air dryers.
4. Underlavatory guards.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with Snow College Standards and these requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Toilet Tissue (Roll) Dispenser:
1. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
2. Mounting: Partition mounted serving two adjacent toilet compartments and / or surface mounted.
3. Operation: Spindleless with tension-spring controlled delivery and self-locking device extending through core that prevents core removal until roll is empty.
4. Capacity: Designed for 4-1/2- or 5-inch-diameter tissue rolls.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Automatic Warm-Air Dryer:
1. Wall mounted hand dryer.
2. Provide a minimum of 1 per 3 sinks at any given location.
3. Automatic-sensor operated with 30-40 second operation range.

D. Liquid-Soap Dispenser:

1. Basis-of-Design Product: Match Snow College campus standards.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Lockset: Tumbler type.
5. Refill Indicator: Window type.

E. Grab Bar:
1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

a. Finish: Smooth, No. 4, satin finish.

3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length: As indicated on Drawings.

F. Vendor:
1. Basis-of-Design Product: Match Snow College campus standards.
2. Type: Sanitary napkin and tampon.
3. Mounting: Semirecessed.
4. Operation: Single coin (25 cents).
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin)
6. Lockset: Tumbler type with separate lock and key for coin box.

G. Sanitary-Napkin Disposal Unit:
1. Basis-of-Design Product: Match Snow College campus standards.
2. Mounting: Partition mounted, dual access or surface mounted.
3. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Seat-Cover Dispenser:

1. Basis-of-Design Product: Match Snow College campus standards.
2. Mounting: Surface mounted or Partition mounted, dual access.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod:
1. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch-thick stainless steel.
2. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
3. Finish: No. 4 (satin).

B. Shower Curtain:
   1. Size: Minimum 6 inches (152 mm) wider than opening by 72 inches (1828 mm) high.
   2. Material: Nylon-reinforced vinyl, minimum 10-oz. or 0.008-inch-thick vinyl, with integral antibacterial agent.
   3. Color: White.
   4. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
   5. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Soap Dish:
   1. Description: Without washcloth bar.
   2. Mounting: Surface mounted.
   3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded-plastic, white.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

END OF SECTION 10801

SECTION 12491 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following blinds with aluminum louver slats:
   1. Miniblinds.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each exposed finish and for each color and texture required.

1.3 QUALITY ASSURANCE

A. Corded Window Covering Product Standard: Unless otherwise indicated, comply with WCMA A 100.1.

PART 2 - PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS

A. Products: Subject to compliance with requirements, provide the following:
   1. As indicated on drawings.

B. Finish: Ionized coating; antistatic, dust-repellent, baked polyester.

   1. Slats: One color as indicated.
   2. Headrails/Valances: Match louver slats as indicated.
   3. Component Color: Rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color.
   4. Colors, Textures, Patterns, and Glosses: **As selected from manufacturer's full range, including metallics**.

C. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
   1. Miniblinds:

      a. Nominal Slat Width: 1/2 inch.
      b. Slat Spacing: Manufacturer's standard.

   2. Nominal Slat Thickness: Not less than 0.008 inch (0.15 mm).

D. Headrail/Valance: Decorative, integrated headrail/valance not requiring a separate valance or end brackets for finished appearance; formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.

E. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends; with enclosed and protected ladders and tapes to prevent their contact with sill.
   1. Top contoured to match crowned shape of louver slat.
   2. Bottom contoured for minimizing light gaps.

F. Maximum Light Blocking Blinds: Designed for eliminating all visible light gaps if slats are tilted closed; with tight tape spacing indicated and slats with minimal-sized rout holes for ladders hidden and placed near back edge for maximum slat overlap; with headrail and bottom rail extended and formed for light-tight joints between rail and adjacent slats or construction.

G. Tilt Control: Enclosed worm gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod.
   1. Tilt Operation: Manual with clear plastic wand.
   2. Length of Tilt Control: Full length of blind.
   3. Tilt: Full.

H. Lift Operation: Manual, top-locking cord lock; locks pull cord to stop blind in either fully opened or fully closed position only and is equipped with a ring pull not more than 4 inches long.

I. Tilt-Control and Cord-Lock Position: Right side and left side of headrail, respectively, unless otherwise indicated.

J. Ladders: Evenly spaced to prevent long-term louver sag.
   1. Material: Braided string.

K. Mounting: End (inside mount) permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
   1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

2.2 FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Fabricated in sizes to fill window and other openings as follows:

   1. Blind Units Installed between (Inside) Jambs:
      a. Width: Equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed.

b. Length: Equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Jamb Mounted: Install headrail flush with face of opening jamb and head.

C. Adjusting: Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Cleaning: Clean blind surfaces after installation, according to manufacturer's written instructions.

END OF SECTION 12491

DIVISION 15
MECHANICAL SPECIFICATION

15010 GENERAL REQUIREMENTS
15051 BASIC MATERIALS AND METHODS GENERAL REQUIREMENTS
15055 MOTORS
15070 VIBRATION, ISOLATION, AND SEISMIC RESTRAINT
15075 PIPE AND EQUIPMENT IDENTIFICATION
15081 DUCT INSULATION
15083 CULINARY WATER PIPE INSULATION
15084 REFRIGERANT PIPE INSULATION
15085 RAINWATER PIPE AND ROOF DRAIN BOWL INSULATION
15088 HEATING HOT WATER PIPE INSULATION
15101 PIPE AND PIPE FITTINGS
15130 PUMPS
15140 HOT AND COLD WATER SYSTEMS
15150 SOIL, WASTE, VENT, AND RAINWATER PIPING SYSTEM
15181 CONDENSATE DRAIN PIPING
15182 HYDRONIC PIPING AND SPECIALTIES
15184 REFRIGERANT PIPING AND SPECIALTIES
15192 NATURAL GAS PIPING
15300 FIRE SPRINKLER SYSTEM
15410 PLUMBING FIXTURES AND TRIM
15416 DRINKING WATER COOLING SYSTEMS
15671 AIR COOLED CONDENSING UNITS
15720 FACTORY CUSTOM BUILT AIR HANDLING UNITS
15801 GENERAL DUCT REQUIREMENTS
15812 ROUND STEEL DUCTWORK
15813 MEDIUM VELOCITY DUCTWORK
15816 STEEL DUCKWORK
15818 FLEXIBLE DUCT
15819 DUCTWORK TESTING
15820 DUCTWORK ACCESSORIES
15822 ACOUSTICAL DUCT LINER
15836 EXHAUST FANS
15841 PRESSURE INDEPENDENT VAV BOXES
15851 DIFFUSERS, REGISTERS, AND GRILLES
15855 PENTHOUSE VENTILATORS
15861 AIR FILTERS
15910 AUTOMATIC TEMPERATURE CONTROLS
15940 SEQUENCE OF CONTROLS
15960 AIR SYSTEM TEST AND BALANCE
15970 WATER SYSTEM ADJUSTING AND BALANCING
15990 FINAL TEST RUN

SECTION 15010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. General Conditions and Division 01 apply to this Division.

1.2 SCOPE:

A. Includes -
   1. Furnish all labor, materials, and equipment necessary for completion of the mechanical work for the Activities Center Addition and Remodel, Snow College, Ephraim, Utah.
   2. Furnish and install all motors specified in this Division and be responsible for the proper operation of electrical powered equipment furnished by this Division.
   3. Furnish exact location of electrical connections and information on motor controls to Division 16.
   4. Mechanical Contractor shall obtain the services of independent Test and Balance Agency.
   5. Placing the air conditioning, heating, ventilating, and exhaust systems into full operation and continuing their operation during each working day of testing and balancing.
   6. Making changes in pulleys, belts, and dampers, or adding dampers, as required for the correct balance as recommended by Balancing Contractor at no additional cost to Owner.
   7. Air balance, final adjustment and test run.
   8. The satisfactory performance of the completed systems is a requirement of this specification.

B. Related Work Specified Elsewhere -
   1. Conduit, line voltage wiring, outlets, and disconnect switches specified in Division 16.
   2. Magnetic starters and thermal protective devices (heaters) not a factory mounted integral part of packaged equipment are specified in Division 16.

1.3 SITE INSPECTION:

A. The Contractor shall examine the site and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

1.4 DRAWINGS:

A. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc; however, locations are to be regarded as shown diagrammatically only. Follow as closely as actual building construction and work of other trades will permit.

B. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate existing structural and finished conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

C. If changes in location of piping, equipment, ducts, etc. are required due to lack of coordination of work under this division, such changes shall be made without charge. Contractor shall review drawings with local and state agencies having jurisdiction and any changes required by them shall be brought to the attention of the Architect prior to bidding or commencement of work.

1.5 SHOP DRAWINGS: (NOT EQUIPMENT SUBMITTALS)

A. Where alternate equipment is selected which has dimensions or arrangement different than that shown of drawings contractor shall provide shop drawings of mechanical room or space showing how alternate equipment shall be integrated.

1.6 CODE REQUIREMENTS, FEES, AND PERMITS:

A. The work shall be installed in accordance with the following applicable codes, ordinances and standards unless otherwise specified. The codes and standards shall include but not be limited to and be of the latest and current editions.

1. Air Movement and Control Association (AMCA)
2. American National Standards Institute (ANSI)
3. Air Conditioning & Refrigeration Institute (ARI)
4. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
5. American Society of Mechanical Engineers (ASME)
6. American Society of Testing Materials (ASTM)
7. American Standards Association (ASA)
8. American Water Works Association (AWWA)
9. American Welding Society (AWS)
10. Associated Air Balance Council (AABC)
11. National Electrical Code (NEC)
12. National Fire Protection Association (NFPA)
13. Sheet Metal and Air Conditioning contractors National Association (SMACNA)
14. Underwriters Laboratories (UL)
15. International Building Code (IBC) 2003 ed
16. International Mechanical Code (IMC) 2003 ed
17. International Plumbing Code (IPC) with Utah Amendments 2003 ed
18. Utah State Safety Orders (OSHA/UOSH)
19. Utah Fire Rating Bureau
20. Utah Boiler and Pressure Vessel Law
21. Utah Air Conservation Regulations/Waste Disposal regulations.
22. ASHRAE Ventilation STD.62-2001.
23. Energy Code for Commercial and High Rise Building ASHRAE/IES NA 90.1-2001.

B. Should drawings conflict with any code, the code shall govern. If drawings and specifications establish a quality exceeding the code, the drawings and specifications shall govern. If conflicts do exist among the drawings,

specifications and codes, the same shall be brought to the attention of the Architect in writing prior to bidding; otherwise Contractor shall comply with applicable codes.

C. The latest edition of all codes shall be used.

D. Contractor shall give all notices, obtain all necessary permits, file necessary plans, prepare documents and obtain approvals, and pay all fees required for completion of the mechanical and plumbing work outlined in this Division of the specifications and shown on the Mechanical Drawings.

1.7 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:

A. Upon completion of work and before final payment, Contractor shall furnish and deliver to the Owner, through the Architect, installation, operation and maintenance manuals with instructions for all new materials and equipment used in the building. The contractor shall provide three hard copies of the manuals, and 3 CD's with electronic copies of the manuals. Electronic information shall be .PDF format. The CD's shall include the same information as the hard copies, and shall be organized in the same manner with electronic bookmarks for each section. CD case and the CD itself shall be labeled the same as the hard copies of the manuals.

B. Bind Operation and Maintenance Manual for Mechanical Systems in a hard-backed piano hinge loose-leaf binder with strong sturdy cover. The project name shall be on the spine and the front of the binder. The front of the binder shall include the following information:

OPERATION
AND
MAINTENANCE
MANUAL
for MECHANICAL SYSTEMS of
(Name of Project)
(Location of Project)
(Date of Project Award)
(Name of Architect)

C. Introduction
   1. Title page including name of project, project number, date awarded and date of substantial completion.
   2. Second page shall contain the names, phone numbers and addresses of Architect, Consulting Engineers, Mechanical Contractor, and General Contractor.
   3. Third page shall include a Table of Contents for the entire manual.

D. First Section - Summary
   1. First page shall contain the contractor's warranties.
   2. Second page shall contain a list of names, addresses and phone numbers of contractors and all sub-contractors and work to which each was assigned.
   3. Final page or pages shall contain an equipment list. The list shall contain each item of equipment or material for which a submittal was required giving ID or tag no as contained on the drawings make and model No. Serial No. Identification No. Location in building, function along with the

name, address, and phone number of the supplier.

E. The second section shall contain Mechanical Equipment O&M data including:
   1. Mechanical maintenance schedule, including a lubrication list when necessary.
   2. Mechanical Equipment Operation and Maintenance Data including:
      a. Equipment descriptions
      b. Detailed installation instruction, operating and maintenance instructions. Instructions include in a step by step manner identifying start-up, operating, shutdown and emergency action sequence sufficiently clear so a person unfamiliar with the equipment could perform its operations.
      c. Equipment drawings, performance curves, operating characteristics, etc.
      d. Name addresses and phone number of manufacturer, fabricator and local vender clearly printed or stamped on cover.
      e. Complete parts listing which include catalog number, serial number, contract number or other accurate provision for ordering replacement and spare parts.
      f. Certified drawings, where applicable, showing assembly of parts and general dimensions.
   3. Approved Mechanical submittals

F. The third section shall contain Plumbing Equipment O&M data including:
   1. Section shall contain general product catalog cuts, as well as exploded view drawings with parts lists for all valves and other items with multiple parts.
   2. Approved Plumbing submittals

G. The fourth section shall contain Controls O&M data including:
   1. Sequence of Operation
   2. Description of each operating system included location of switches, breakers, thermostats, and control devices. Provide a single line diagram, showing set points, normal operating parameters for all loads, pressures, temperatures and flow check points; Describe all alarms and cautions for operation.
   3. Provide schematic control diagrams, panel diagrams, wiring diagrams, etc. for each separate fan system, chilled water system, hot water system, exhaust air system, pumps, etc. Each control diagram shall show a schematic representation of mechanical equipment and location of start-stop switches, insertion thermostats, thermometers, pressure gauges, automatic valves, etc. The correct reading for each control instrument shall be marked on the diagram.

H. The fifth section shall contain a complete air and water test and balance report. The report shall contain the name, address and phone number of the agency. It shall also include:
   1. Floor plans showing all air openings and thermometer locations clearly marked and cross referenced with data sheets. Format may be 8 1/2 x 11 or 11x14 if legible.
   2. Data sheets showing amount of air and water at each setting. See sections 15960 and 15970.
   3. List of equipment with date of last calibration.

I. Drawings and reproducible masters of drawings as required in individual specification sections, are not to be bound in volumes but are to be delivered

separate with the maintenance manuals.

J. See the following checklist for assistance in assembling manual:

Item #	Description	Y, N, or NA
1.	3 ring heavy duty binder with Project name, number and date on cover and project name on spine.	
2.	O&M manual on CD (with label on CD matching label on manual). Electronic copy shall be a PDF file with bookmarks that match the tabs in the hard copy.	
3.	Title Page [including project name, number, address, date awarded, date of substantial completion]	
4.	Second Page Contact List [including architect (if applicable), mechanical engineer, mechanical contractor, and general contractor (if applicable)]	
5.	Table of Contents	
6.	**Section 1 - Summary**	
A.	Warranty	
B.	Mechanical's Sub-contractor List	
C.	Vendor List	
D.	Equipment List	
7.	**Section 2 – Mechanical Equipment**	
A.	Maintenance Schedule (including lubrication list)	
B.	Mechanical Equipment O&M Data (for each piece of equipment submitted) per specifications	
C.	Approved mechanical submittals	
8.	**Section 3 – Plumbing Equipment**	
A.	Plumbing equipment O&M data	
B.	Approved plumbing submittals	
9.	**Section 4 - Controls**	
A.	Sequence of Operation	
B.	Controls diagrams	
C.	Controls Equipment	
10.	**Section 5 – Test and Balance Report**	
A.	Complete Test and Balance Report per specifications	

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Contractor shall instruct building maintenance personnel in the operation and

maintenance of the installed mechanical systems utilizing the Operation and Maintenance Manual when so doing.

B. Minimum instruction periods shall be as follows -
   1. Mechanical - Four hours.
   2. Plumbing - Two hours
   3. Temperature Control - Four hours.

C. Instruction periods shall occur before final inspection when systems are properly working and before final payment is made.

D. None of these instructional periods shall overlap each other.

E. An additional four hours of instruction will be provided by each contractor, after 60 days of system operation by owner to insure proper system operation and answer questions.

1.9 RECORD DRAWINGS:

A. Contractor shall keep an up-to-date set of mechanical and plumbing drawings in his custody showing all changes in red, clearly defined and neatly drafted by him. At the end of construction, he shall turn these drawings over to the Architect. Record drawings must be completed and submitted prior to final inspection.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 15010

SECTION 15051 - BASIC MATERIALS & METHODS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. Division 15010 General applies to this Section.

1.2 COORDINATION OF WORK:

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for the installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making application to the Architect in writing. Should conditions arise where certain changes would be advisable, secure Owner's and Architect approval for these changes before proceeding with work.

B. Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Architect. Changes required in work specified in Division 15 caused by neglect to secure approval shall be made at no cost to Owner.

C. Arrange piping, ductwork, and equipment to permit ready access to valves, unions, starters, motors, control components, and to clear openings of doors and access panels. Contractor shall provide all necessary access doors and/or panels to provide complete access to all mechanical equipment, dampers, or accessories. Doors for dampers, etc. shall be minimum 12" x 12" and doors for mechanical equipment shall be minimum 24" x 24".

D. Furnish and install supports required by Division 15 unless otherwise noted. Furnish supports, and equipment that are an integral part of other Divisions involved in sufficient time to be built into the construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Contractor.

E. Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Owner and Architect. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

1. Patch and repair walls, floors and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
2. This Division shall bear expense of cutting, patching, repairing, and replacing of work of other Divisions because of its fault, error, tardiness, or because of damage done by it.

F. Adjust locations of piping, ductwork, equipment, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and cut prior to fabrication.

1. Make offsets, transitions, and changes in direction of piping, ductwork, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

G. Slots and openings through floors, walls and roofs shall be provided by this Division.

H. This Contractor shall schedule his work, store his equipment and materials, and

work in harmony with other Contractors so as to not delay or jeopardize the construction.

I. This Division shall coordinate with electrical contractor to insure that all required components of control work are included and fully understood. Any discrepancies shall be called to the attention of the Architect before completion of bids. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.3 EQUIPMENT & MATERIALS:

A. Requests for substitution shall be received in writing a minimum of seven days prior to bidding. Prior acceptance shall be by Manufacturer's name only. Items not listed in this specification or subsequent addendums shall not be considered. No oral approvals will be acceptable. Manufacturers listed in this specification are acceptable only for items listed. All other items manufacturer wishes to bid must be prior approved. All equipment shall be subject to final review in accordance with "Project Submittals".

B. Product Approvals -
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

C. Use <u>domestic made</u> pipe, pipe fittings, equipment, and motors on Project.

D. Motor and equipment name plates as well as applicable UL labels shall be in place when Project is turned over to Owner.

E. Insure that items to be furnished fit spaces available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. Do not scale off drawings.

F. All materials shall be of the best commercial quality obtainable, consistent with specified materials and for the purpose or function intended. Materials shall be new unless specifically noted.

G. Equipment catalog or model numbers shown define the basic equipment types and quality standard only. Catalog numbers shall not be considered as all inclusive and shall be verified to include all devices, controls, operators, and appurtenances necessary for the satisfactory and complete operation of the equipment.

H. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.

1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain Architect=s written instructions before proceeding with work. Contractor shall bear all expenses arising from correcting deficiencies of work that does not comply with Manufacturer's directions or such written instructions from Architect.

I. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.

1.4 PROJECT SUBMITTALS:

A. Furnish complete catalog data for manufactured items of equipment to be used in the Work to Architect for review within 15 days after award of Contract.

B. Submittal shall include, but not be limited to the following:
   1. Equipment scheduled
   2. Balancing contractor
   3. Insulation
   4. Grilles and diffusers
   5. Automatic temperature controls
   6. Certificates of guarantee
   7. Valves
   8. Plumbing fixtures, accessories, and specialties
   9. Any item for which more than one manufacturer is mentioned

C. Submit a minimum of five copies of data in binders and index in same order and name as they appear in Specification.
   1. State sizes, capacities, brand names, motor HP, electrical requirements, accessories, materials, gauges, dimensions, and other pertinent information.
   2. List on catalog covers page numbers of submitted items.
   3. Underline or highlight applicable data.

D. If material or equipment is not as specified or submittal is not complete, it will be rejected.

E. Catalog data or shop drawings for equipment which are noted as being reviewed by Engineer shall not supersede Contract Documents.

F. Review comments of Engineer shall not relieve this Division from responsibility for deviations from Contract Documents unless Engineer-s attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

G. Check work described by catalog data with Contract Documents for deviations and errors.

H. All items other than first named specified equipment shall show and state all exceptions and deviations taken and shall include design calculations and drawing layouts.

I. The Contractor shall review the submittals prior to submission to the Architect to make sure that the submittals are complete in all details. No submittal will be reviewed which does not bear the contractor's notation that such checking has been made.

J. No partial submittals will be considered unless approved by the Architect-s Engineer.

K. Manufacturers' names shall be mentioned as acceptable prior to bidding.

L. Contractor shall verify equipment dimensions to fit the spaces provided with sufficient clearance for servicing the equipment.

M. Contractor shall review equipment submittals for compliance with schedules, specifications, and drawing plans and details. Equipment submittal shall show the proper arrangements to suit installation and maintenance such as motor location, access doors, filter removal, piping connections, etc.

N. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment. Submittals shall clearly indicate name of manufacturer of each item.

O. For unacceptable items, the right shall be reserved to require the first named

specified items.

P. Where submittals are sent to Architect with any of the above listed information missing or are incomplete they will be returned to the contractor unchecked to be completed and resubmitted. No additional time or money shall be allowed for failure to provide complete submittals on the first review.

Q. If an item requiring submittal review is ordered, purchased, shipped, or installed prior to the submittal review and is subsequently disapproved the item shall be removed from the job site and replaced with an approved item at contractors expense.

1.5 CLEANING & FINISHING:

A. Contractor shall, at all times, keep the premises free from waste material and rubbish. Upon completion of this Section of the work, Contractor shall remove all surplus materials and rubbish; clean all spots resulting from the mechanical work from hardware, floors, glass, walls, etc.; do all required patching up and repair all work of other trades damaged by Contractor under this Section of the work, and leave the premises in a clean orderly condition. Clean heating and cooling coils, internally and externally, and replace all air filters prior to final mechanical inspection. Remove rust, plaster, dirt, grease and oil before painting, insulating, or exposing to view the equipment, piping, ductwork, etc. in completed structure. Refinish any damaged surfaces and leave in proper working order at final completion.

1.6 EQUIPMENT SERVICING:

A. Prior to starting mechanical equipment, all motors, bearings and moving parts shall be properly oiled, greased and lubricated as required. Full and adequate maintenance service shall be given and upon completion all equipment shall be cleaned and checked and placed in perfect condition for the Owner.

B. Provide lubrication for the following:
   1. Air Handling Units
   2. Exhaust fans
   3. Damper motors
   4. Pumps
   5. VAV boxes
   6. Air cooled condensing units

C. Amount and type of lubricant shall be per manufacturer's specification.

1.7 SUPERVISION:

A. The Contractor shall supervise and direct the work with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will be responsible to see that the finished work complies accurately with the Contract Documents.

1.8 SAFETY REGULATIONS:

A. Contractor shall provide equipment, supervision, construction, procedures, and everything necessary to assure safety of life or property.

B. Refer also to General Condition and Special Conditions for protection clauses.

1.9 LEAK DAMAGE:

A. Contractor shall be responsible for damages to the work of other Contractors or to the building, or to its contents, people, etc., caused by leaks in any of the equipment or piping installed by him through equipment or material failures, leaking joints or disconnected pipes, fittings, or by overflows and shall make at his own expense all repairs to fixtures, building interior, contents, paint, rugs, furniture, ceiling tile, and equipment so damaged.

1.10 TOOLS AND STORAGE OF EQUIPMENT:

A. The Contractor shall furnish all necessary tools, staging and whatever may be necessary for the installation of this work and shall at all times protect this work and others, and the materials to be used therein from damage by the weather, accident and other causes, and shall repair and make good any damage thus occurring.

1.11 WORKMANSHIP:

A. Workmanship shall be the best quality of its kind for respective industries, trades, crafts and practices and shall be acceptable in every respect to the Owner and Architect. Nothing contained herein shall relieve the Contractor from performing good work, perfect in all details of construction.

1.12 TEMPORARY FACILITIES:

A. Furnishing of temporary water, space heating, sanitary facilities, drainage lines, light and power will be as specified in Division 01 General Conditions. Contractor shall arrange to bring facilities to required location of premises. All expenses involved shall be paid by the Contractor as described in General and Special Conditions.

1.13 EQUIPMENT BASES:

A. Provide reinforced concrete bases under pumps, air handling units, and other equipment as necessary or as indicated on the drawings. Coordinate work with Division 03.

B. Bases shall be 4" high, above the finish floor. The base shall extend beyond the equipment 4" in all directions, where possible. Inserts and vibration isolation systems shall be provided and installed by the Mechanical Contractor at the time the concrete is poured to accommodate and anchor the equipment used. Coordinate with vibration isolation manufacturer's requirements and Section 15070. Provide a one inch beveled edge all around.

1.14 BELT GUARDS:

A. Shall be provided, properly enclosing each belt drive system. Guards shall be easily removable, constructed of expanded metal with suitable frames corresponding with SMACNA standard and with tachometer openings. Coordinate with equipment suppliers to avoid duplication of belt guards supplied

with equipment. Guards shall comply with OSHA Regulations.

1.15 ELECTRICAL WORK:

A. Power wiring to all electrically driven apparatus shall be done under the electrical contract. See Electrical Specifications.

B. Unless specifically noted otherwise on documents, Electrical Contractor shall furnish and install all magnetic starters including properly sized heaters, and disconnect switches as indicated on drawings or required by code.

C. The Contractor shall verify the proper operation of equipment furnished by him. Costs for repair, replacing, re-wiring and retesting shall be borne by the Contractor without additional costs to the Owner.

D. Motors shall be as specified in Section 15055.

1.16 CONTRACTOR'S USE OF BUILDING EQUIPMENT:

A. The Contractor may use equipment such as electric motors, fans, filters, etc. when permanently installed as part of the project and with the written permission of the Owner. As each piece of equipment is used, maintenance procedures approved by the manufacturer shall be followed, a careful record shall be kept of the time used, maintenance procedure following and of any difficulty experienced with equipment. The Contractor's records on the equipment shall be submitted to the Owner upon acceptance of project. All fan belts and filter media shall be new at the beginning of the Mechanical System Operating Test Run and System Balancing. Wearing surfaces (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted shall require replacement.

1.17 INSPECTION NOTICE:

A. The following is a basic list of guideline items so that the Architect, building inspector/Owner=s representative can be at job site for these inspections as the building progresses. Mechanical Contractor shall inform these people one week in advance of test time.

1. Water tests on all sewer, waste, and rainwater piping prior to piping being concealed. See section 15010.
2. Pressure tests on all water service piping. See section 15010.
3. Pressure tests on hot water supply and return piping. See section 15010. Pressure tests on refrigerant piping. See section 15184.
4. All duct work prior to installation of finished ceilings, including ductwork pressure testing. See section 15819.
5. The initial start-up of mechanical equipment, etc.
6. Any changes or problems occurring at job site.
7. Inspect all vent flashings on roof prior to roofing.
8. Periodic inspection at their discretion will be made to insure compliance to Contract Documents and codes. Contractor shall provide ladders, access and other assistance as requested during inspections.
9. Final inspection before giving approval for final payment.

1.18 WARRANTY GUARANTEE:

A. The Contractor shall warrant all materials and equipment to be of quality

consistent with specifications as represented by manufacturer's published data.

B. The Contractor shall guarantee that the installation and operation of the equipment shall be free from defects for a period of one year beginning at date of substantial completion and acceptance. The Contractor shall replace or repair any part of the installation that is found to be defective or incomplete within the guarantee period.

C. The one year guarantee on equipment and systems shall commence when equipment has been demonstrated to work and has been accepted. (Example: If an equipment item fails to perform and it takes 9 months after substantial completion to correct, then the guarantee shall commence after the item has been demonstrated to perform and has been accepted.)

D. Substantial completion and acceptance in no way relieves the Contractor from providing the systems and equipment as specified.

1.19 COMPLETION SCHEDULE:

A. Start-up and verification of basic equipment items shall be done prior to the date of substantial completion with sufficient time to allow balancing and adjusting to be performed.

B. At the time of the final inspection a date shall be agreed upon for completion of any remaining items. At least double the estimated cost of the work will be withheld from the Contractor's payment.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 15051

SECTION 15055 - MOTORS

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. All motors used in Division 15.

1.2 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.3 SUBMITTALS:

A. Section 15051

PART 2 - PRODUCTS

2.1 MOTORS:

A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating. Speed shall not exceed 1800 rpm unless otherwise noted.
B. All motors shall be domestic made motors regardless of size.
C. All motors shall be designed, wound, and name plated for the voltage shown and the service indicated on the drawings. All motors operating outdoors shall be fully weather and waterproof.
D. All motors shall be re-rated or adjusted for service in job site altitude atmosphere.
E. All motors shall be copper wound and have overload protection on all legs.
F. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather-protected.
G. Motor sound power levels shall not be greater than recommended in NEMA MG 1-12.49.
H. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.
I. All motors shall be ball bearing type and shall comply with noise level standards as set by NEMA Standard MG1-12.47. Motor bearings shall be rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports.
J. Provide motors with aluminum end brackets with steel inserts in bearing cavities.
K. All motors 2 HP or smaller shall be:
   1. Squirrel cage
   2. Single phase 115/1/60
   3. Capacitor start
   4. Induction run
   5. Class B insulation
   6. Rated 40 C continuous rise
   7. Split-phase or shaded pole type
   8. May be supplied by the equipment manufacturer.

L. All motors 1 HP and larger shall be:
   1. Class B motor temperature rise
   2. Class F insulation.
   3. 1.15 Service factor
   4. High efficiency motors. High efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Guaranteed minimum load efficiency shall be as follows:

MOTOR HP	FULL LOAD RPM	GUARANTEED MINIMUM FULL LOAD EFF.
3	1750	86.5
5	1750	86.5
7-1/2	1750	88.5
10	1745	88.5
15	1760	90.2

M. Motors controlled by VFD=s
   1. Designed and Warranted for Invertor Duty Use (Nema MG-31 certified) for VFD motors.

N. Approved Manufacturers.
   1. GE
   2. Lincoln
   3. Reliance
   4. Louis Alis

PART 3 - EXECUTION

3.1 TESTING:

A. After all motor driven equipment is installed and in proper operating condition, Contractor, jointly with the Electrical Contractor, shall make load, speed and rotation tests. Any motor which fails to comply with requirements of the specifications or to operate satisfactorily, shall be adjusted or replaced as directed.

END OF SECTION 15055

SECTION 15070 - VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing engineering and materials necessary for vibration isolation and seismic restraints for equipment contained herein for the project.
   1. Other Sections of DIVISION 15 for a part of this section. Refer to all sections for a complete description of the work
   2. Section 15101 - Pipe and Pipe Fittings
   2. Section 15130 - Pumps
   3. Section 15140 - Hot and Cold Water Systems
   4. Section 15510 - Hydronic Piping
   5. Section 15182 - Refrigeration piping and specialties

B. All mechanical equipment .75 HP and over listed in the equipment schedule shall be mounted on vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure.
   1. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer and shall be certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
   2. The contractor and manufacturer of the isolation and seismic equipment shall refer to the isolator and seismic restraint schedule which lists isolator types, isolator deflections and seismic restraint type.Vibration isolators shall be selected in accordance with the equipment , pipe or ductweight distribution so as to produce reasonably uniform deflections.

C. Install full line size flexible pipe connectors at the inlet and outlet of each pump, condensing unit, cooling coil connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipe fitting schedule. Control rods or protective braid must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.

D. Unless otherwise specified, all mechanical, electrical, and plumbing equipment, pipe, and duct shall be restrained to resist seismic forces. Restraints shall maintain equipment, piping, and duct work in a captive position. Restraint devices shall be designed and selected to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.
   1. For this project all systems shall be considered to be essential with an Ip=1.5

1.2 SEISMIC RESTRAINT SHALL NOT BE REQUIRED FOR THE FOLLOWING

A. Rigidly floor mounted mechanical, electrical, and plumbing components in all seismic design categories, where Ip=1.0 and flexible connections between the components and associated ductwork, piping and conduit are provided, that are mounted at 4 feet (1219 mm) or less above a floor level and weight 400 pounds (1780) or less and are not critical to the continued operation of the structure. Suspended, wall mounted and flexibly mounted equipment are not included in

this exclusion.

B. Hanging, wall mounted, and flexibly supported mechanical, plumbing and electrical components that weigh 20 pounds (89 N) or less, where Ip=1.0 and flexible connections are provided between the components and associated duct work, piping and conduit.

C. Piping supported by individual clevis hangers where the distance, as measured from the top of the pipe to the supporting structure, is less than 12 inches (305mm) for the entire pipe run and the pipe can accommodate the expected deflections. Trapeze or double rod hangers where the distance from the top of the trapeze or support to the structure is less than 12 inches for the entire run. Hanger rods shall not be constructed in a manner that would subject the rod to bending moments (swivel, eye bolt, or vibration isolation hanger connection to structure).

D. High deformability piping (steel, copper with welded, braized, ground, or screwed connections) designated as having an Ip=1.5 and a nominal pipe size of 1 inch (25 mm) or less where provisions are made to protect the piping from impact or to avoid the impact of larger piping or other mechanical equipment. Note, any combination of piping supported on a trapeze where the total weight exceeds 10lb/ft. Must be braced

E. High deformability piping (steel, copper with welded, brazed, ground, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designed with an Ip=1.0 and a nominal pipe size of 1 inch and less in the mechanical equipment room, or 2" and less outside the mechanical equipment room.

F. HVAC ducts suspended from hangers that are 12 inches (305 mm) or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections. Duct must be positively attached to hanger with minimum #10 screws within 2" from the top of the duct.

G. HVAC duct with an Ip=1.5 that have a cross-section area less than 4 square feet. HVAC ducts with an Ip=1.0 that have a cross sectional area of less than 6 square feet(0.557 m2)

H. Equipment items installed in-line with the duct system (e.g, fans, heat exchangers, and humidifiers) with an operating weight less than 76 pounds (334 N). Equipment must be rigidly attached to duct at inlet and outlet.

1.3 MANUFACTURER=S RESPONSIBILITIES: Manufacturer of vibration and seismic control products shall have the following responsibilities.

A. Determine vibration isolation and seismic restraint sizes and locations.

B. Provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified.

C. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.

D. Provide calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, latest edition. Seismic calculations shall be certified by a licensed engineer licensed in the State of Utah in the employ of the seismic equipment manufacturer with a maximun 5 years experience. Provide calculations for all floor or roof mounted equipment 400lbs (1780 N) or greater (20lbs (89 N) or greater for Ip=1.5), all suspended or wall mounted equipment 20lbs (89 N) or greater, and vibration isolated equipment 20lbs (89 N) or greater.

E. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer licensed in the State of Utah.

F. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compasive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.

1.4 QUALITY CONTROL

A. The isolators and seismic restraint systems listed herein are as manufactured by:

1. Amber/Booth.
2. Mason Industries
3. Korfund
4. Vibration Mounting and Controls
5. Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA)

B. Steel components shall be cleaned and painted with industrial enamel. All nuts, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be throughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

C. All isolators, bases, and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts, and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb./sq. Ft. applied to any exposed surface of the equipment.

D. Provide a written quality control procedure that outlines complete compliance of attachment and cabling restrains to brackets. For swaged connections, provide a gage to verify swage. For screw/clamp connection, provide torque values for attachment fasteners.

1.5 SUBMITTALS

A. Submit shop drawings of all isolators, seismic restraints and calculations provided (para 1.3)

B. The manufacturer of vibration isolation products shall submit the following data for each piece of isolated equipment: clearly identified equipment tag, quantity and size of vibration isolators and seismic restraints for each piece of rotating isolated equipment. Submittals for mountings and hangers incorporating spring shall include spring diameter and free height, rated deflections, and solid load. Submittals for bases shall clearly identify locations for all mountings as well as all locations for attachment points of the equipment to the mounting base. Submittals shall include seismic calculations signed and checked by a qualified licensed engineer licensed in the State of Utah in the employ of the manufacturer of the vibration isolators. Catalog cut sheets and installation instructions shall be included for each type of isolation mounting or seismic restraint used on equipment being isolated.

C. Submit quality assurance procedures as required under 1.4.D at time of isolator/seismic submittals. Submitals must be stamped by a registered

professional engineer licensed in the State of Utah who is responsible for the seismic restraint design. All vibration isolation/seismic submittals not complying with this certification will be rejected.

D. Provide shop drawings indicating location of all specification SC cable restraints (section 2.3.B) required for pipe and ductwork. Drawing must be stamped by manufacturer-s registered professional engineer licensed in the State of Utah.

E. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that there is capability of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

F. Provide a certification from the seismic design engineer that the seismic restraints will comply with the applicable code requirements. Certification must be stamped by a registered profession engineer licensed in the State of Utah.

G. Provide a Certificate of Completion from the manufacturer-s representative upon completion of the job.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Specification B: an adjustable, freestanding, open spring mounting with combination leveling and equipment fastening bolt. The spring shall be welded to the spring mounting baseplate and compression plate for stability. The isolator shall be designed for a maximum kx/kx (horizontal-to-vertical spring rate) of 1.0. An elastromeric pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Nuts, adjusting bolts and washers shall be zinc-electroplated to prevent corrosion. This type isolator must be used with specification SL seismic restraint (Section 2.3.A). Isolators shall be Amber/Booth Type SW.

B. Specification SB: a unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment. Restraints shall allow a maximum of 1/4"movement before engaging and shall allow for the spring to be changed if required. Isolator shallbe a stable spring with a minimum ky/ky of 1.0. The spring package shall include an elastromeric pad for high frequency absorption at the base of the spring. Nuts and bolts shall be zinc-electroplated to prevent corrosion. Bolting equipment to isolator with bolts smaller than main adjusting bolt will not be allowed. Base plate shall provide means for bolting to the structure. Entire assembly shall be rated to exceed the applied seismic load (para 1.3) Mountings shall be Amber/Booth Type SWSR

2.2 SEISMIC RESTRAINTS:

A. Specification SL: a restraint assembly for floor mounted equipment consisting of welded steel interlocking assemblies welded or bolted Securely to the equipment or the equipment bases and to the supporting structure. Restraint assembly surfaces which engage under seismic motion shall be lined with a minimum 1/4" thick resilient elastromeric pad to protect equipment. Restraints shall be field adjustable and be positioned for 1/4" clearance as required to prevent interference during normal operation. Restraint assembly shall have minimum rating of 2 times the catalog rating at 1 G as certified by independent laboratory

tests. Restraint shall be Amber/Booth Type ER.

B. Specification SC: a restraint assembly for suspended equipment, piping or ductwork consisting of high strength galvanized steel aircraft cable. Cable must have Underwriters Laboratories listed certified break strength, and shall be color-coded for easy field verification. Secure cable to structure and to braced component through bracket or stake eye specifically designed to exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per AISI Manual for structural applications of steel cables and ASTM A630. Break strengths must be per ASTM E-8 procedures. Safety factor of 1.5 may be used when prestretched cable is used with end connections designed to meet the cable break strength. Otherwise safety factor 3.76 must be used. Cables shall be sized for a force as listed in section 1.3. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be type LRC.

2.3 FLEXIBLE PIPE CONNECTIONS

A. Specification K: Water Service: For flanged connection - a double sphere arch rubber expansion joint constructed of molded reinforced neoprene with integral steel floating flanges, and designed to be suitable for pressures up to 225 PSI (4 to 1 safety factor) and temperatures up to 225 degrees F. Connectors shall have minimum movement capabilities of 1.77" compression, 1.18" lateral and 1.18" extension. Connectors shall provide a minimum 35B angular movement up to 6", minimum 30B up to 12" and minimum 20B up to 24". Spring-loaded control units shall be furnished to limit movement to within allowables. Amber/Booth Type 2600

1. Water Service: For threaded type - Double spherical rubber hose connector, minimum 8" long, constructed of molded neoprene, nylon cord reinforced, with female pipe unions each end. Connectors shall have a minimum movement capability of 7/8" compression, 7/8" lateral, 1/4" extension and 20B angular through 1-1/4", 13B through 2", and 9B through 3". Connectors shall be suitable for a maximum working pressure (4 to 1 safety factor) of 150 psi and 225 degree F. Connectors shall have cable control units to limit extension to 1/4". Amber/Booth Type 2655.

PART 3 - EXECUTION

3.1 GENERAL

A. Isolator and seismic restrains shall be installed as recommended by the manufacturer. Isolate all mechanical equipment 0.75 hp and over per the isolation schedule and these specifications.

3.2 PIPING ISOLATION

A. Horizontal Pipe Isolation: all HVAC pumped water, glycol, and refrigerant piping size 1-1/4" and larger within mechanical rooms shall be isolated . Outside equipment rooms this piping shall be isolated for the greater of 50' or 100 pipe diameters from rotating equipment. For the first 3 support locations from externally isolated equipment provide specification E hangers or specification SB

os SX floor mounts with the same deflection as equipment isolators (max 2"). All other piping within the equipment rooms shall be isolated with the same specification isolators with a 3/4" minimum deflection. Steam piping size 1-1/4" and larger which is within an equipment room and connected to retating equipment shall be isolated for three (3) support locations from the equipment. Provide specification E or SB (SX) isolators with the same deflection as the equipment but a minimum of 3/4"

B. All plumbing pumped water, size 1-1/4" and larger within mechanical rooms shall be isolated the same as HVAC piping (para 3.2.A.) Isolators are not required for any plumbing pumped water, outside of mechanical rooms unless listed in the isolation schedule

C. Pipe Riser Isolation: All variable temperature vertical pipe risers 1-1/4" and larger, riser piping requiring isolation per para 3.2.A or 3.2.B or where specifically shown and detailed on riser drawings shall be fully supported by specification B mounts with precompression plates. Steel spring deflection shall be 3/4-inch minimum except in those locations where added deflection is required due to pipe expansion and contrction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the risers in tension. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, reset diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed. Riser supports shall be Amber/Booth Type SWP

3.3 DUCT ISOLATION

A. Isolate all ductwork with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type E hangers or type SB (SX) floor mounts.

3.4 INSTALLATION

A. Comply with manufacturers instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary support during installation or shipping.

B. Locate isolation hangers as near the overhead support structure as possible.

C. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

D. Install isolated inertia base frames and steel base on isolator units as indicated so that a minimum of 2 inch clearance below base will result when supported equipment has been installed and loaded for operations.

3.5 APPLICATION OF SEISMIC RESTRAINTS

A. Isolated Equipment

1. All floor mounted isolated equipment shall be protected with type SB or type C unitized isolator and restraint or with separate type SL restraints (minimum of 4) in conjunction with type B isolators. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking. All suspended isolated equipment and vessels shall be protected with specification SC restraints. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation.

B. Rigidly Mounted Equipment

1. Floor mounted which are not exempt (para 1.1.D) shall be protected by properly sized anchor bolts with elastomeric grommets provided by the isolation manufacturer. Suspended equipment shall be protected with type SC bracing.

C. Piping

1. All piping shall be protected in all planes by SC restraints, designed to accommodate thermal movement as well as restrain seismic motion. (Spring-loaded control rods should be used on flexible connectors in system) Tanks and vessels connected inline to piping shall be restrained independently. Locations shall be as determined by the isolator/seismic restraint supplier and shall include, but not be limited to:
   a) At a proximity to protect all drops to the equipment connections.
   b) At changes in direction or pipe as required to limit over stressing of pipe movement that contacts other building material
   c) At horizontal runs of pipe, not to exceed the spacing as presented in Amber/Booth design criteria.
   d) SMACNA design criteria. Seismic restraints shall not be required for piping exempted by paragraph 1.2.
2. Where riser pipes pass through cored holes, core diameters to be a maximum of 2" larger than pipe O.D> including installation. Cored holes must be packed with resilient material or fire stop as provided by other sections of this specification or local codes. No additional horizontal seismic bracing is required. Restrained isolators type C or SB shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints. For risers in pipe shafts, specification SC cable shall be installed at each level in a manner that does not interfere with thermal movement.

D. DUCTWORK

1. Ductwork 6 square feet and larger in cross sectional area shall be protected in all planes by SC restraints. Locations shall be determined by the isolator supplier and shall include, but not limited to:
   a) at equipment connections as required to protect the connections.
   b) at all duct runs and duct run ends (transverse bracing and longitudinal bracing not to exceed spacing specified in Amber/Booth, or SMACNA guidelines)

E. The isolation and/or seismic restraint listed shall be furnished and installed for the equipment listed in the table below in accordance with the previous sections of this specification:

EQUIPMENT ISOLATION SCHEDULE

	A: CRITICAL (35'-50')			B UPPER STORY (20'-35' SPAN)			C: GRADE		
EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFL. (IN)	BASE (1) TYPE	ISOLATOR TYPE	MINIMUM DEFL. (IN)	BASE (1) TYPE	ISOLATOR TYPE	MINIMUM DEFL. (IN)	BASE (1) TYPE
AIR HANDLING UNITS FLOOR MOUNTED UP TO 15 HP	SWSR	1.5	-	SWSR	.75	-	SWSR	.75	-
REFRIGERATION UNITS RECIP. COND. UNITS	SW	2.5	CPF	CTER	1.5	-	SWSR	.75	-

END OF SECTION 15070

SECTION 15075 - PIPE AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE:

A. Piping Identification
   1. All pipes shall be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
      a. Adjacent to each valve.
      b. At every point of entry and exit where piping passes through a wall or floor.
      c. On each riser and junction.
      d. A maximum of every 50 feet on long continuous lines fully exposed to view. Less spacing if one cannot see one code from the adjacent.
      e. Adjacent to all special fittings or devices (regulating valves, etc..
      f. Connection to equipment.

B. Duct Identification
   1. Ductwork shall be identified at or near the fan.

C. Equipment Identification
   1. Identify all mechanical equipment, ATC panels, junction boxes, and all other devices.

D. Valve Tagging
   1. All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The Contractor shall furnish and install approved brass tags for all designated items, with numbers and letters on the tags corresponding to those on the charts and diagrams.
   2. Each valve shall have an identifying number identifying the unit. Standard identifications may be used for identifying type of service or fluid in pipe. The Contractor shall submit his system of identification to the Owner and Architect for approval prior to ordering. Any work done without this approval is done at the Contractor's own risk.
   3. Charts of all valves shall be furnished to Owner in duplicate by the Contractor. Charts shall indicate the following items:
      a. Valve identification number
      b. Location
      c. Service or purpose
      d. Normal Position

PART 2 - MATERIALS

2.1 PIPING IDENTIFICATION:

A. Labels and markers shall be of the self-sticking, all-temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Ave., Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

B. Pipe color coding shall be uniform throughout the building and comply with requirements of ANSI A13.1.

C. Letters of identification legend and directional flow arrows shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.
D. Proposed identification system shall be approved by Owner and Architect prior to installation.

2.2 DUCT IDENTIFICATION:

A. Ductwork shall be identified at or near the fan, with stenciled signs or by engraved laminated plastic signs secured with rust proof screws. Sign shall indicate area served and direction of air flow.

2.3 EQUIPMENT IDENTIFICATION:

A. Equipment shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters. Signs shall be securely attached by rust proof screwed or some other permanent means (no adhesives).
B. Information on signs shall include name of equipment, identification on plans and schedules, rating maintenance instructions and any other important data not included on factory attached name plate.

2.4 VALVE TAGGING:

A. Brass tags shall not be less than 1-1/2" diameter with depressed black-filled numbers not less than 1/2" high and black-filled letters not less than 1/4" high. Tags shall be securely fastened to valves with approved brass "S" hooks, or brass jack chain, in a manner to permit easy reading. Do not attach to valve wheel. Brass tags shall be as manufactured by Seton Name Plate Company, New Haven, Connecticut or approved equal.
B. Permanent plastic cover for chart shall have two (2) holes to be punched at top of plastic closure to allow for affixing approximately an 8" length of nickel plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plate Company, New Haven, Connecticut, or equal.

PART 3 - EXECUTION

3.1 PIPING IDENTIFICATION:

A. Markers shall be installed in strict accordance with manufacturer's instructions. Use vinyl tape first and stick markers over tape. This procedure assures that the tape will not fall off.
B. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass covering, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
C. On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.
D. Stenciling may be used in lieu of the above labels and markers if finished

application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling, is used, letter heights, background colors, banding and arrows shall be as specified above. Submit sample to Owner before proceeding with work.

E. Apply markers so they can be read from floor.

3.2 DUCT IDENTIFICATION:

A. Identify all ducts exposed in mechanical equipment room. A sample duct identification shall be as follows: Supply air VAV System Dance and Fitness Areas.

3.3 EQUIPMENT IDENTIFICATION:

A. Signs shall be attached to equipment so they can be easily read. Attachment shall be by screws or rivets. Glue shall not be used.

B. A sample identification sign for equipment shall be as follows: AH-1 Air handler single zone North West Area 13,220 cfm.

C. NOTE: Avoid using only the engineers designations as used on plans; identify equipment as to area or zone served.

3.4 REMOVABLE AND NON-REMOVABLE CEILING TILE:

A. Where valves, VAV boxes, fire dampers, adjustment controls, etc. are located above ceiling tile, an identification on the lay in tile tee bar shall be provided to indicate the tile to be removed for access to a particular item. In general, 1/2 inch high black stick on or stencil letters are to be used indicating the device such as VAV for VAV box, CWV for cold water valve, E for other electrical devices, etc. The code used shall be provided in the operations and maintenance manual.

B. For non-accessible ceiling and ceilings without tee bars, provide hinged access doors at each valve, fire damper, damper operator and VAV box.

3.5 VALVE TAGGING:

A. Provide one valve chart mounted in a frame with clear glass front, and secured on a wall in the equipment rooms, or in a location as otherwise directed by the Owner.

B. Identify all valves. A sample identification as follows:

VALVE #1
COLD WATER
OPEN

C. Sample Identification Chart is as follows:

1. The room numbers used on the actual chart shall be the room numbers actually used. Do not use architectural room numbers shown on plans.

SAMPLE VALVE IDENTIFICATION CHART

NUMBER	DESCRIPTION	LOCATION	NORMAL POSITION
1.	Cold water supply to hose bibb.	Room #	Open
2.	Hot water supply to toilet room.	Chase #	Open

END OF SECTION 15075

SECTION 15081 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of concealed round above grade supply air ducts that are not lined. All ductwork routed outside of building insulation envelope.
   2. Insulation shall have surface burning characteristics as determined by ASTM E84 with a flame spread rating of 25 and a smoke developed of 50.

B. Related Work specified Elsewhere -
   1. Acoustical insulation inside air ducts is specified in Section 15822.
   2. Insulated flex duct specified in Section 15818.

PART 2 - PRODUCTS

2.1 INSULATION:

A. 1-1/2 inch thick fiberglass with aluminum foil scrim kraft facing and have a density of one lb/cu ft.

B. Approved Manufacturers:
   1. Johns-Manville Microlite FSK
   2. CSG Type IV standard duct insulation
   3. Owens-Corning FRK-25
   4. Knauf (Duct Wrap FSK)

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install duct wrap in accordance with Manufacturer's recommendations.

B. Do not compress insulation except in areas of structural interference.

C. Joints shall be completely sealed.

END OF SECTION 15081

SECTION 15083 - CULINARY WATER PIPE INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of all above ground culinary hot water, recirculating hot water, and cold water lines and fittings, and underside of wall hung lavatories for handicapped.
   2. The insulation products used on the project shall be of one manufacturer, unless specifically excepted. All pipe insulation shall meet the requirements of IBC.
   3. Insulation products on this project shall be installed by a licensed insulation contractor using materials, and methods described in this section. Installation by other than an experienced licensed contractor shall not be acceptable.

PART 2 - PRODUCTS

2.1 INSULATION:

A. Snap-on glass fiber pipe insulation with surface burning characteristics as determined by ASTM E84 with a flame spread rating not to exceed 25 and smoke developed not to exceed 50.
B. Snap-on glass fiber pipe insulation. Heavy density pipe insulation with a factory applied ASJ vapor barrier jacket.
C. Approved Manufacturers:
   1. Owens-Corning
   2. Johns-Manville
   3. CSG
   4. Knauf
D. Thickness shall be as noted in Table 1.

2.2 COVERING:

A. Where piping is susceptible to damage, and/or routed below 6'0" above finished floor, provide with heavy duty PVC jacket.
   1. Jacket material shall be a minimum of .030 inches thick and white in color unless directed otherwise by Architect.
   2. Approved Manufacturers
      a. Ceel-Tite 320 by Ceel Co.
      b. Prior approved equal

PART 3 - EXECUTION

3.1 PIPING:

A. General
   1. Pipe insulation shall be continuous through the sleeve.
   2. A PVC jacket shall be provided over the insulation wherever caulking is

required.

3. Insulation shall be continuous through hangers.
4. Support points such as hangers shall have a calcium silicate support block. See section 15101. Inserts provided by insulation manufacturer shall also be acceptable.

B. Cold Lines

1. Insulation shall be applied to clean, dry pipe with joints tightly butted and the ends of the insulation sealed off with vapor barrier coating at intervals not to exceed 15 feet.
2. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
3. All laps and butt strips shall be secured with adhesive and stapled on 4-inch centers.
4. Staples and seams, including those on self-sealing lap systems shall be coated with a vapor barrier coating.
5. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating as specified for butt strips. The patch shall extend not less than 1-1/2 inches past the break.
6. At penetrations such as thermometers, the void in the insulation shall be filled with vapor barrier coating and the penetration shall be sealed with a brush coat of the same coating.

C. Hot Lines

1. Insulation shall be applied to clean, dry pipe with joints tightly butted.
2. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
3. Laps and butt strips shall be secured with adhesive and stapled on 4-inch centers. Adhesive may be omitted where pipe is concealed.
4. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as noted for butt strips. Patch shall extend not less than 1-1/2 inches past the break.
5. The run of the line pipe insulation shall have the ends brought up to the item.
6. At penetrations such as thermometers, the void in the insulation shall be filled with vapor barrier coating and the penetration shall be sealed with a brush coat of the same coating.

3.2 FITTINGS:

A. Insulate fittings with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in or tapered.

B. Cover insulation with one piece "Zeston" type PVC fitting cover or equal by Ceel Co.secured by stapling or taping ends to adjacent pipe covering.

C. Alternate Method -

1. Insulate fittings with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending two inches onto adjacent insulation.

TABLE 1
Pipe Insulation Thickness

PIPE SYSTEM	PIPE SIZE THICKNESS		
	LESS THAN 1"	1" TO 1-1/4"	1-1/2" TO 4"
HOT WATER	1/2"	1/2"	1"
COLD WATER	1/2"	1/2"	1"

END OF SECTION 15083

SECTION 15084 - REFRIGERANT PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flexible Foamed Pipe Insulation
   1. Thickness -
      a. 1/2 inch for one inch outside diameter and smaller pipe.
      b. 3/4 inch for 1-1/8 through 2 inch outside diameter pipe.
      c. One inch for 2-1/8 inches outside diameter and larger pipe (two layers of 1/2 inch).
      d. One inch sheet for fittings as recommended by Manufacturer.
   2. Approved Manufacturers -
      a. AP Armaflex by Armstrong
      b. Halstead Insul-Tube
      c. Rubatex
B. Joint Sealer
   1. Approved Manufacturers -
      a. Armaflex 520
      b. BFG Construction Adhesive No. 105
      c. Rubatex R-373
C. Insulation Tape
   1. Approved Manufacturers -
      a. Armaflex AP Tape
      b. Rubatex R-180-FS Tape
D. Exterior Finish
   1. Approved Manufacturers -
      a. WB Armaflex Finish by Armstrong
      b. Rubatex Protective Coating 67x944
E. Sleeves - Galvanized 26 ga steel, 9 inches long

PART 3 - EXECUTION

3.1 INSTALLATION

A. For condensing units, install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.
B. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
   1. Insulate flexible pipe connectors.
   2. Insulate thermal expansion valves with insulating tape.
   3. Insulate fittings with sheet insulation and as recommended by

Manufacturer.

C. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.

D. Install insulation on lines through clamp assembly of pipe support. Do not butt insulation up against sides of clamp assembly. Install sleeve around insulation at each clamping location to prevent crushing of insulation when clamp is tightened.

E. Stagger joints on layered insulation. Seal joints in insulation.

F. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.

G. Paint exterior exposed insulation with two coats of specified exterior finish.

END OF SECTION 15084

SECTION 15085 - RAIN WATER PIPE AND ROOF DRAIN BOWL INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of above ground rainwater pipe and roof drain bowl.
   2. The insulation products used on the project shall be of one manufacturer, unless specifically excepted. All pipe insulation shall meet the requirements of IBC.
   3. Insulation products on this project shall be installed by a licensed insulation contractor using materials, and methods described in this section. Installation by other than an experienced licensed contractor shall not be acceptable.

PART 2 - PRODUCTS

2.1 INSULATION:

A. Snap-on glass fiber pipe insulation with surface burning characteristics as determined by ASTM E84 with a flame spread rating not to exceed 25 and smoke developed not to exceed 50.
B. Snap-on glass fiber pipe insulation. Heavy density pipe insulation with a factory applied ASJ vapor barrier jacket.
C. Approved Manufacturers:
   1. Owens-Corning
   2. Johns-Manville
   3. CSG
   4. Knauf
D. Thickness shall be as noted in Table 1.

2.2 COVERING:

A. Where piping is susceptible to damage and where piping is routed below 6'-0" AFF, provide with heavy duty PVC jacket.
   1. Jacket material shall be a minimum of .030 inches thick and white in color unless directed otherwise by Architect.
      a. Approved Manufacturers
         1) Ceel-Tite 320 by Ceel Co.
         2) Prior approved equal

PART 3 - EXECUTION

3.1 PIPING:

A. General
   1. Pipe insulation shall be continuous through the sleeve.
   2. A PVC jacket shall be provided over the insulation wherever caulking is required.
   3. Insulation shall be continuous through hangers.

4. Support points such as hangers shall have a calcium silicate support block. See section 15101.

B. Piping

1. Insulation shall be applied to clean, dry pipe with joints tightly butted and the ends of the insulation sealed off with vapor barrier coating at intervals not to exceed 15 feet.
2. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
3. All laps and butt strips shall be secured with adhesive and stapled on 4-inch centers.
4. Staples and seams, including those on self-sealing lap systems shall be coated with a vapor barrier coating.
5. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating as specified for butt strips. The patch shall extend not less than 1-1/2 inches past the break.
6. At penetrations shall be filled with vapor barrier coating and the penetration shall be sealed with a brush coat of the same coating.

3.2 FITTINGS:

A. Insulate fittings with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in or tapered.

B. Cover insulation with one piece "Zeston" type PVC fitting cover or equal by Ceel Co.secured by stapling or taping ends to adjacent pipe covering.

C. Alternate Method -

1. Insulate fittings with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending two inches onto adjacent insulation.

TABLE 1
Pipe Insulation Thickness

PIPE SYSTEM	PIPE SIZE THICKNESS		
	LESS THAN 1"	1" TO 1-1/4"	1" AND LARGER
RAINWATER AND ROOF DRAIN BOWL	1/2"	1/2"	1/2"

END OF SECTION 15085

SECTION 15088 - HEATING HOT WATER PIPE INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of heating hot water supply and return piping and fittings and valves.

PART 2 - PRODUCTS

1.2 INSULATION:

A. Snap-on glass fiber pipe insulation with surface burning characteristics as determined by ASTM E84 with a flame spread rating not to exceed 25 and smoke developed not to exceed 50 when tested to UBC Standards.
B. Fiberglass sectional pipe insulation with ASJ jacketing.
C. Approved Manufacturers -
   1. Owens-Corning
   2. Johns-Manville
   3. Knauf
D. Thickness shall be as noted in Table 1.

1.3 COVERING:

A. Where piping is susceptible to damage and in equipment rooms, provide with heavy duty aluminum jacket.
   1. Jacket material shall be standard material supplied for use as insulation jacketing and shall be smooth. Corrugated material is not acceptable.

PART 3 - EXECUTION

3.1 PIPING:

A. General
   1. Pipe insulation shall be continuous through the sleeve.
   2. An aluminum jacket shall be provided over the insulation wherever caulking is required.
   3. Insulation shall be continuous through hangers.
   4. Support points such as hangers or rollers shall have a calcium silicate block at support point. See section 15101. Inserts supplied by insulation manufacturer may also be used.
   5. Insulation shall be applied to clean, dry pipe with joints tightly butted.
   6. Longitudinal laps of the ASJ jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
   7. Laps and butt strips shall be secured with adhesive and stapled on 4-inch centers. Adhesive may be omitted where pipe is concealed.
   8. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, stapling, and

coating as noted for butt strips. Patch shall extend not less than 1-1/2 inches past the break.

9. The run of the line pipe insulation shall have the ends brought up to the item.

3.2 FITTINGS:

A. Insulate fittings with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in or Tapered.

B. Cover insulation with one piece "Zeston" PVC fitting cover or equal by Ceel Co. secured by stapling or taping ends to adjacent pipe covering.

C. Alternate Method -

1. Insulate fittings with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending two inches onto adjacent insulation.

TABLE 1
Pipe Insulation Thickness

PIPE SYSTEM	PIPE SIZE THICKNESS			
	LESS THAN 1"	1" TO 1-1/2"	2" TO 3"	4" AND LARGER
LOW TEMP HOT WATER	1"	1"	1-1/2"	1-1/2"

NOTE: Piping routed outside of building insulation envelope shall have insulation thickness increased 1/2".

END OF SECTION 15088

SECTION 15101 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Division 15010 General applies to this Section.

1.2 SCOPE:

A. Includes -
   1. General piping installation, materials and procedures for all piping systems.
B. Related Work Specified Elsewhere -
   1. Type of pipe and fittings for culinary water, heating hot water, refrigerant, drainage, etc. shall be specified in that particular Section.
   2. Piping hangers and supports specified in this section are for piping not covered under section 15070. Contractor shall coordinate with section 15070 supplier to avoid duplication.

PART 2 - PRODUCTS

2.1 HANGERS:

A. Provide one of the following types of hangers for horizontal piping. Comparable products of Grinnell, Globe Pipehanger, B-Line, Michigan Hanger, Superstrut or Piping Technology and Products (PTP) considered equal.
B. Except as otherwise specified hereinafter: Clevis type, B-Line Fig. B3100.
C. Where pipe exceeds maximum loading recommended for Clevis type Hangers, provide steel pipe clamp, B-Line Fig. B3140 or Fig. B3142, depending on loading.
D. Provide trapeze hangers where several pipes can be installed parallel and at the same level. Trapeze hangers shall consist of 2 steel channels bolted back to back spaced for rod hangers at each end. Use roller chairs B-Line B3120 pipe roll stands B-Line B3117 SL where provision for expansion is required.
E. Supporting rods shall be attached to existing and new structure as required by Section 15070
F. Supporting rods over 18 inches long shall be braced at every fourth hanger with diagonal bracing attached to slab or beam.
G. Spring hangers shall be used for support of pipe within 100 diameters distance of coils, or pumps, as needed to isolate vibration. Springs shall be sized 1" static deflection. Vibrex type HXAP-PC adjustable spring hangers.
H. For copper tubing use copper hanger; or dielectrically isolate.

2.2 FLOOR SUPPORTS:

A. Provide one of the following means of supporting horizontal piping from floor:
B. Pipe Saddle Support, B-Line, Fig. B3095 with pipe nipples to suit. Fasten to floor.
C. Where provision for expansion are required, pipe-roll stands, B-Line Fig. B3120 without vertical adjustment, B-Line Fig. B3122 with vertical adjustment as required. Provide concrete piers, fasten stands to piers.

2.3 WALL SUPPORTS:

A. Provide one of the following means of supporting horizontal piping from wall:
B. B-Line B-200 pipe clamp.
C. For hanger suspension, 750 pound maximum loading, light welded steel bracket with hole for one rod, 3/4 inch diameter. B-Line Fig. B3068.
D. For pipe roll stand support, welded-steel bracket, light for 700 pound maximum loading, B-Line Fig. B3063, medium for 1500 pound maximum loading Fig. B, heavy for 3000 pound maximum loading Fig. B3067.

2.4 VERTICAL PIPING SUPPORTS:

A. Vertical pipe supports shall be steel extension pipe clamps, B-Line Fig. B3373 or Fig. B3131, refer to manufacturer's rated maximum loading for each size pipe. Bolt clamp securely to pipe, rest clamp-end extension on building structure.
B. Where pipe sleeves extend above floor, place pipe clamps at ceiling below, support clamp-end extension from inserts.

2.5 ROOF-MOUNTED PIPING SUPPORTS

A. For Refrigerant Piping
   1. Stand shall be height adjustable without removing stand from roof.
   2. Base shall be made of injection molded, pressed and recycled plastic and rubber, or of stainless steel.
   3. Upright members shall be standard threaded steel rods of size to support weight of piping.
   4. Cross member shall be B-line, Unistrut or equal steel channels made to accept pipe clamps and hangers. Channel shall be sized to carry weight of pipe.
   5. Configuration shall be as detailed on the drawings..
   6. Cover shall be 18 gauge steel, hot dipped galvanized to meet requirements of ATSM A 361 1.25 oz/sq. foot. Paint per requirements of Section 09900. Color to be selected by Architect.
B. Approved Manufacturers
   1. Portable Pipe Hangers, model PP10
   2. Model AH by Miro Industries
   3. Prior approved equal

2.6 CLAMPS:

A. Beam clamps shall be malleable iron, B-Line Fig. B442 for 1/4 inch hanger rods; forged steel beam clamp, B-Line B321 for hanger rod up to 1-1/2 inches.

2.7 PIPE COVERING PROTECTION:

A. Provide calcium silicate blocks in the bottom 1/2 diameter of pipe to protect insulation at areas of contact with hangers and supports. Material shall be 8 inches long for pipes up to 3 inches and 12 inches long for pipes 3-1/2 inches and larger. Insulation manufacturer supplied inserts shall be acceptable.

2.8 WALL AND CEILING PLATES:

A. Fit pipes passing through walls, floors, and ceiling with wall plates of proper size to cover openings around pipes. Plates will not be required at floor slabs where sleeves project above floor and space between pipe and sleeve is caulked and sealed. Plates shall be equal to Beaton and Cadwell No. 10, pressed steel plates. Floor plates shall be chromium plated. Wall and ceiling plates shall be prime coated.

2.9 UNIONS AND COUPLINGS:

A. Unions: Malleable iron, brass to iron seat, ground joint, same materials as pipe. Crane, Walworth, or approved equal.
B. Dielectric Unions: Mechanical Contractor shall install dielectric union or couplings whenever copper pipe connects to steel pipe or other items of equipment. Couplings and unions shall be as manufactured by the Water Vallot Company of Detroit, Michigan, or approved equal.

2.10 PIPING SPECIALTIES:

A. Provide thermometers, pressure gages, vents, tank fittings, and other miscellaneous piping specialties as shown or as may be required by usual good practices for a complete system.
B. Thermometers shall be 9" scale, red reading, glass covered, immersion type with separable sockets. Marshall-Town, Moeller, Trerice, Weskler, or Weiss, with neck extension to accommodate insulation.
C. Pressure gages shall be 4-1/2" diameter dial, molded case dust proof, phosphor bronze, bourdon tube type installed with integral check screw or pressure snubber. Marshalltown 224, U.S., Ashcroft, Trerice or Marsh.
D. Manual air vents shall be installed at all high points in piping system and drain valves at system low points. Manual air vents shall be 3/8" globe valves on 6" long pipe nipple with 1/4" copper tubing to near floor. Drain valves shall be fitted for 3/4" hose connection with vacuum breaker. Provide access for valves.

2.11 STRAINERS:

A. Walworth 3699 - 1/2 Sarco SB; bronze, smaller than 2-1/2 inches. Bailey 125 pound No. 100; Zurn 125 pound No. 540 FPS; or Crane No. 989-1/2, cast iron 2-1/2 inches and larger. Water straining element shall be perforated 20 mesh monel screen. Strainers shall be designed for the same working pressure as the control valves. Provide strainer blowoff port with line size hose bibb and vacuum breakers.

2.12 VALVES:

A. Provide on each valve a name plate showing manufacturer, valve size, grade, and pressure temperature service rating.
B. See specific piping system sections for valves to be used in that system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install a complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.

B. Properly support piping and make adequate provision for expansion, contraction, slope, and anchorage.
   1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
   2. Do not use pipe hooks, chains, or perforated metal for pipe support.
   3. Remove burr and cutting slag from pipes.

C. Piping shall not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

D. Make connections of dissimilar metals with insulating couplings.

E. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.
   1. Seal sleeves with plastic or other acceptable material.
   2. All piping passing through floors and outside walls and foundations shall have a water tight sleeve and water tight caulking around pipe. Extend pipe sleeve minimum of 3 inch above floor.

F. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of systems. Do not use plugs of rags, wool, cotton waste, or similar materials.

G. Install piping systems so they may be easily drained.

H. Do not place water piping within building perimeter in contact with earth.

I. Valves of same type shall be of same Manufacturer.

J. Do not use reducing bushings, street elbows, or close nipples.

K. Make changes in direction with proper fittings. Bending of pipe is not approved.

L. Hanger rods shall be of a diameter adequate to support pipe size.

M. Install additional supports as required.

N. Suspend all piping in building except that underground. Laying of piping on any building member is not allowed.

O. Design all hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to General Requirements specified in sub-paragraph.

P. Horizontal Piping Support Schedule: Support horizontal piping of steel, cast iron, plastic, and copper as follows:

HORIZONTAL PIPING SUPPORT SCHEDULE

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4"	3/8"	8'-0"
1-1/2" and 2"	3/8"	10'-0"
2-1/2" and 3"	1/2"	10'-0"
4" and up	5/8"	12'-0"

Q. Piping with nonpressure type joints such as Soil and Waste Piping shall be supported with a minimum of two hangers per pipe section.

R. Support horizontal lines of copper tubing with hangers. Space not more than 8 feet center to center.

S. Cutting or other weakening of the building structure to facilitate installation will not be permitted. The Contractor shall demonstrate that no weight or stress is placed upon the equipment by the piping and that piping and connection of equipment are in perfect alignment. When so directed, disconnection and reconnection of piping shall be done by Contractor for designated pipe section to properly demonstrate stress; this shall be at no cost to Owner.

T. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to insure noiseless circulation. All valves and specialties shall be placed, packed and adjusted at the completion of the work before final acceptance.

U. Operating Valves shall be accessible for operation from floors or platforms where feasible, and hand wheels shall not be more than 4'-6" above the floor or platform. In other cases, valves and cocks shall be equipped with chain operated hand wheels or extension stems, or other suitable means of remote control.

1. Tighten glands and add additional gland packing as required before final inspection.

V. Provide sufficient clearance for insulated piping and fittings to permit application of insulation without cutting either pipe line covering or fitting coverings.

3.2 PIPE PROTECTION:

A. Do not run piping in outside wall, or where freezing may occur. Piping in attic spaces shall be run on the interior side of building insulation.

B. No water piping in building shall be in contact with earth.

C. All piping as installed shall be plugged or capped until equipment has been permanently connected.

3.2 GRADE AND DRAINAGE:

A. All piping shall be erected to insure proper draining. Grade soil, waste, and drainage lines not less than 1/4" per foot unless noted otherwise on drawings. Grade rain water lines minimum 1/8" per foot.

B. Heating water, condenser water and domestic hot and cold water lines shall be graded so as to drain system with as few drains as possible. Drains shall be

located in convenient and accessible places. All drainage piping shall extend to floor drains.

3.3 CROSS CONNECTIONS:

A. No plumbing fixture, device or piping shall be installed which will provide a cross-connection or interconnection between a distributing water supply for drinking or domestic purposes and polluted source.

B. Provide all hose bibbs and equipped with a hose connection with a vacuum breaker.

3.4 FLEXIBLE CONNECTIONS:

A. Shall be provided wherever pipe connects to motor operated equipment.

3.5 DIELECTRIC FITTINGS:

A. Shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

3.6 PIPE JOINTING:

A. All steel pipe shall be joined by flanged, or screwed connections or by welding. Where welding is employed, welding type fittings with beveled ends shall be used. The mitering of pipes to form elbows and the notching of straight runs to form tees will not be allowed. Copper pipe shall be soldered. All piping shall be cut to length by hack-saw or pipe cutter. Cutting of pipe with a torch will not be allowed.

B. Threaded Piping:

1. Threading shall be American-Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Limit number of threads so that not more than two (2) threads will show beyond fitting.
2. All pipe joints shall be properly sealed with thread coatings applied to the male thread. Sealer for culinary water piping shall be Teflon tape. Sealer for steel pipe in heating, waste and vent lines shall be powdered graphite and Linseed oil or plumage and linseed oil or "Type-Unyte", or Teflon tape.

C. Soldered Piping:

1. Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for sweated fittings shall be made with a non-corrosive paste flux and solid wire solder. Use 95-5 or 96-4 Tin-Antimony solder. Cored solder will not be permitted.

D. Welding:

1. Welders shall be certified-
   a. Welders shall be certified and shall bear evidence of certification within 30 days prior to commencing work on this project.
   b. If there is any doubt as to the proficiency of the welder, the Owner may require the welder to take another test. This shall be done at no additional expense to the Owner.

c. Welders shall be certified in accordance with section IX of the ASME Boiler and Pressure Vessel Code by Pittsburgh Testing Laboratories or other Testing Agency acceptable to the Owner.

2. Piping 2" and larger, and all piping routed in concealed areas reguardless of size shall be welded except as noted. Welding shall be done using either gas or electric welding equipment. No electric welding shall be done when the atmospheric temperature is below 40 degrees F. without first preheating the ends of the pipe. Thoroughly clean all piping surfaces before welding. The width of circumferential welds shall be 2-1/2 times the wall thickness of the pipe. Piping shall be securely aligned and spaced. The deposited metal shall form a gradual increase in thickness from the outside surface to the center of the weld. Make welds in at least two beads. Each shall be cleaned using stiff wire brushes or pointed descaling tools. The final beads shall be similarly cleaned for inspection.

3. Fittings -
   a. All fittings shall be ASA Standard fittings and shall be of standard pipe thickness.
   b. All elbows shall be long radius.
   c. Wherever tee connections are made to piping systems on the main run, welding sockets shall be installed for the branch connections up to one half the size of the main run, welding tees shall be used.
   d. The use of fittings formed from welded pipe sections and or notching of pipe will not be permitted. Changes in pipe size shall be made with tapered fittings.
   e. Connection to equipment shall be flanged using std 150 psi weld neck flanges or flanges rated for pressure of system encountered. Gaskets shall be non-asbestos type of material suitable for temperature, pressure and substance in system.
   f. All welding fittings used in welding system shall be manufactured by Tube Turns Inc., Taylor Forge and Pipe Works, Midwest Piping and Supply Co., or Bonney Forge and Tool Works, for AWeld-O-Lot@ or Thread-O-Lot@, or approved equal fittings and shall match the pipe in which they are installed.

4. Safety precautions -
   a. The contractor shall provide a fire proof mat or blanket to protect the structure, and adequate fie protection at all locations where welding is done.

5. Testing and acceptance -
   a. Engineer and Owners Representative shall at their disgression shall inspect welds. If welds are found to be suspect, contractor shall provide testing of questionable welds at contractors expense.
   b. Testing shall be by radiograph, ultrasonic, sectioning or a combination of these methods at the option of the Owner.
   c. The contractor shall test a minimum of 6 welds up to a maximum of 1/4 of all welds on project as selected by Engineer.
   d. Tests shall be preformed by a recognized independent testing agency acceptable to all parties. Agency shall submit a test report.
   e. If defective joints are discovered Owner shall have right to require all welds removed and redone or remaining welds tested and all defective welds replaced. All work to test, remove and replace

welds shall be at contractor's expense.

3.7 FLASHINGS:

A. Wherever roof is pierced by work installed by this Contractor, he shall furnish proper flashings to be installed by the Roofing Contractor. All piercings of roof shall be sealed air and water tight.

B. Provide proper flashings, counter flashings, metal collars or other work as required to make weather tight seal at all fan connections, duct piercings, etc., as shown and/or required for work installed under this Contract.

C. All pipes passing through the roof shall be neatly flashed with Stonemen Stormite four pound seamless lead flashing assembly, with reinforced conical boot, complete with vandal-proof hooded cast iron counter flashing and Permaseal waterproofing compound. Hood shall have a minimum of 2 to 1 free area to vent pipe size. Flashing flanges shall be an 18 inch square base. Coordinate work with Roofing Contractor to avoid duplication of flashings and work.

D. 16 oz sheet copper flashings may be used in lieu of lead. Flashing shall be fitted snugly around pipe. Caulk between flashing and pipe to seal. Make water and air tight using a flexible waterproof compound. Base shall be 24" square.

E. Roof drains shall have a 36"x36" pan.

3.8 PIPE CLEANING AND DISINFECTION:

A. All piping shall be flushed clean before connection to equipment. Water lines shall be thoroughly flushed out with alkaline detergent solution to remove pipe dope, oil, loose mill scale, and other extraneous materials. See individual piping sections for specific cleaning and disinfection requirements.

3.9 PIPE TESTING:

A. Test all piping prior to insulating, backfilling or other concealment. Valve off or isolate controls, fittings, equipment or other piping which may be damaged by testing pressures. Provide relief valves set to avoid bursting pressure during test.

B. Soil, waste, rainwater and vent systems shall be filled to roof level with water and show no leaks over a 24 hour period.

C. Domestic water and heating hot water supply and return piping shall be hydrostatically tested at 100 psi with less than a four percent drop in pressure over a six hour period.

D. Natural gas piping see Section 15192.

END OF SECTION 15101

SECTION 15130 - PUMPS

PART 1 - GENERAL

1.1 SUMMARY:

A. Scope: Extent of pump work required by this Section is indicated on the drawings and schedules, and by requirements of this Section, and Section 15010.
B. Types of pumps specified in this Section:
   1. Frame-mounted end suction
   2. In line circulators
C. Other Sections: Refer to Division 16 sections for power wiring, starters, and disconnects.

1.2 QUALITY ASSURANCE:

A. Codes and Standards: Provide pumps conforming to the following standards:
   1. Hydraulic Institute (HI): Manufacture pumps in accordance with "Standards for Centrifugal Pumps."
   2. Underwriters Laboratories, Inc. (UL): Manufacture pumps in accordance with UL 778 "Motor Operated Water Pumps".
   3. UL and National Electrical Manufacturers Association (NEMA): Provide electric motors and components which are listed and labeled by UL and comply with NEMA standards.
B. Certification: Provide pumps whose performances, under specified operating conditions, are certified by the manufacturer.
C. Manufacturers tech service representative shall align pumps at start of pumps and after first month of operation

1.3 SUBMITTALS:

A. Conform to the requirements of Section 15051, "Submittals."
B. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current pump characteristic performance curves with selection points clearly indicated.
C. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight loadings, required clearances and methods of assembly of components.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Delivery: Handle pumps carefully to prevent damage, denting and scoring. Do not install damaged pumps or components; replace with new.
B. Storage: Store pumps and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage until installation.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS: GENERAL

A. General: Provide factory tested pumps, thoroughly cleaned, and painted with machinery enamel prior to shipment. Type, size, and capacity of each pump is

listed in the pump schedule. Provide pumps of the same type by the same manufacturer.

B. Non-Overloading: Motor brake horsepower shall not be exceeded at any point of the pump characteristic curve.

C. Rising Curve: Pump characteristic curve shall rise continuously from maximum capacity to shut-off, with shut-off head minimum 10 percent greater than the design head.

D. Working Pressure: Construct pumps for the working pressure in pounds per square inch specified or indicated. Factory test at 1.5 times working pressure.

2.2 IN-LINE CIRCULATOR PUMPS

A. Rated for 125 psi maximum working pressure and 225 deg F maximum operating seal temperature.

B. In-line centrifugal type with cast iron body, bronze impeller, carbon seals, flexible coupling, flanged connections, and quiet operating, ring mounted motor.

C. Motor - 1750 rpm maximum with 120 volt, single phase, 60 Hertz electrical connections and built-in overload protection.

D. Approved Manufacturers & Models -
   1. Bell & Gossett
   2. Armstrong
   3. Grundfos
   4. Thrush

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS:

A. General: Install pumps where indicated, with the arrangements shown and in accordance with manufacturer's published installation instructions.

3.2 ADJUSTING AND CLEANING:

A. Alignment: Check alignment and, where necessary, realign shafts of motors and pumps within the recommended tolerances of the manufacturer, but not greater than plus or minus 0.002 inches, measured with a dial indicator.

B. Start-Up: Lubricate pumps before start-up and start-up in accordance with manufacturer's instructions.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15130

SECTION 15140 - HOT AND COLD WATER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Furnish and install all culinary hot, recirculating hot, and cold water piping shown on the drawings complete with necessary valves, connections, and accessories inside the building and connect into cold water service piping where shown on the drawings.
   2. All water systems shall meet the requirements of ANSI/NSF Standard 61 Section 9 (1998), concerning metal contaminants in the water system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Inside Building
   1. Hot and cold water service piping: Type L, copper, hard drawn with wrought copper fittings.

2.2 VALVES:

A. Interior culinary water valves shall be ball type.
   1. Con Bra Co AApollo@
   2. Hammond
   3. Honeywell - Braukmann
   4. Jenkins
   5. Milwaukee
   6. Nibco - Scott
   7. Stockham
   8. Watts
B. Thermostatic Control Valve Set
   1. Completely factory assembled and tested unit.
   2. Unit shall be of rough bronze piping, valves, strainers, fittings etc. comprised of following.
      a. Two thermostatic mixing valves complete with liquid-filled thermostatic motors one for low capacity and one for high capacity.
         1) High capacity valve shall incorporate a dirt and lime resistant feature on the valve seat.
      b. Triple duty construction strainer check stops on both hot and cold water inlet to valves.
      c. Pressure regulating valve that responds to varying flow and allows the high capacity valve to come into operation at a preset pressure.
      d. Ball type shut-off valves.
      e. Dial type pressure gauges on inlet and outlet of pressure regulating valve.
      f. Dial type thermometer on outlet of valve set.
      g. Carefully placed unions to allow for easily removing parts with out

disassembly of entire unit or removal of unit from system.

3. Unit shall be provided with cabinet.
4. Unit shall be of capacity as shown on drawings.
5. Approved Manufacturers
   a. Lennard
   b. Powers

2.3 VACUUM BREAKERS AND BACKFLOW PREVENTERS:

A. Backflow preventers and vacuum breakers shall be installed in water lines to provide protection against cross contamination. Such devices shall be of approved manufacture and installed in accordance with the Uniform Plumbing Code. Provide backflow preventers for:
   1. Hose bibbs
   2. Any fixture that accommodates a hose or tubing connection (i.e. faucets, etc.)
   3. Make-up water lines to mechanical equipment
   4. Any item required by code to have same

B. Backflow preventers, vacuum breakers and completed assembly shall comply with the International Plumbing Code.

2.4 HYDRAULIC SHOCK (WATER HAMMER) CONTROLS:

A. Provide hydraulic shock controls for flush valves and water header. Shock controls shall be Smith, Zurn, Wade, or Josam.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For general piping installation, see Section 15101**.**

B. Piping Inside of Building
   1. Provide valves on hot and cold water lines to rest rooms and class rooms, for zone control of system. Provide access for all valves.
   2. Do not run piping in outside walls or ceiling space unless it is located on the building side of insulation envelope.
   3. Locate cold water piping a minimum of six inches from hot water piping.
   4. Before pipes are covered, buried, etc. Contractor shall test the piping installation in the presence of the Engineer, and Owners Representative. Piping shall be tested as described in Section 15101.

C. Pipe Sterilization and Disinfection
   1. Water piping shall be flushed clean as described in section 15101 then the shutoff valve to the water main shall be closed. All fixture outlets shall be opened slightly. A solution of sodium hypochlorite and clean water shall be introduced at the new tie-in to the existing water pipes downstream of new valve, until residual chlorine is detected at all water faucets, outlets, etc. The solution shall consist of 1 gallon of 5 percent sodium hypochlorite (Chlorox or Purex) to 200 gallons of water. The solution shall be flushed and all aerators and strainers shall be removed, cleaned and replaced. Care shall be taken to not allow solution to enter existing piping.

2. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.
3. Water system will not be accepted until a negative bacteriological test is made on water taken from system. Chlorine dosing shall be repeated as necessary until such negative test is accomplished.
4. When connecting into existing water lines, Contractor shall properly protect and cap the existing piping or Contractor shall stand the cost of cleaning and disinfecting the existing piping system to Owner's satisfaction.
5. Contractor shall furnish to Owner and Architect a written report certifying that pipe cleaning and disinfection has been completed and accepted.

END OF SECTION 15140

SECTION 15150 - SOIL, WASTE, VENT AND RAINWATER PIPING SYSTEM

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Furnish and install all soil, waste, rainwater and vent piping systems within the building and to a point 5'-0" outside of building or at termination of rainwater drainage system at catch basins.

B. Related Work Specified Elsewhere -
   1. Roof drains specified in Section 15410.

C. Coordination
   1. Coordination with Division 02 for tie-ins to site work.

1.2 REFERENCES:

A. American Society For Testing And Materials
   1. ASTM A 74-96, 'Standard Specification for Cast Iron Soil Pipe and Fittings'
   2. ASTM C 564-95a, 'Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings'

PART 2 - PRODUCTS

2.1 CAST IRON PIPING AND FITTINGS

A. Buried Piping
   1. Minimum size of waste piping installed under floor slab on grade shall be 2 inches.
   2. Approved Types -
      a. Service weight, single-hub type cast iron soil pipe meeting requirements of ASTM A 74.
         1) Joint Material -
            a) Single-Hub - Rubber gaskets meeting requirements of ASTM C 564.

B. Above Grade Piping And Vent Lines
   1. Approved Types -
      a. Service weight, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A 74.
         1) Joint Material -
            a) Single-Hub - Rubber gaskets meeting requirements of ASTM C 564.
            b) No-Hub Pipe - Neoprene gaskets with stainless steel cinch bands.
         2) Vent lines 2-1/2 inches or smaller may be Schedule 40 galvanized steel

C. Fittings
   1. Cast Iron Pipe: meeting requirements of ASTM A-74
      a. Hub and spigot tyseal type with rubber gaskets meeting requirements of ASTM C-564 (underground)

b. No hub pipe with stainless steel cinch bands

2. Galvanized Pipe - Screwed Durham tarred drainage type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For general piping installation requirements, see Section 15101.

B. ALL PIPING:

1. Excavation and backfill shall be as specified in Division 02 with the following additional requirements.
   a. Runs shall be as close as possible to those shown on drawings.
   b. Excavate to required depth.
   c. Grade to obtain fall required. Piping shall be laid on compacted sand, true to line and grade - blocking not allowed.
   d. Bottom of trenches shall be hard. Tamp as required.
   e. Remove debris from trench prior to laying of pipe.
   f. Do not cut trenches near footings without consulting Architect.
   g. Bury outside pipe 12 inches minimum below frost line or 36 inches minimum below finish grade, whichever is deeper.
2. Regulatory Requirements
   a. Install clean outs in accordance with local governing authority and State codes.
3. Performance Requirements
   a. Failure to install joints properly shall be cause for rejection and replacement of piping system.
4. Remove excess earth from site or place as directed by Architect.

C. Metal Pipe And Fittings

1. Provide depression under bell of each joint to maintain even bearing of sewer pipe.
2. Connect to existing piping as required.
3. Use jacks to make-up gasketed joints.
4. Do not calk threaded work.
5. Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

D. PLACE CLEAN OUTS:

1. Where shown on Drawings and at base of each stack and riser.
2. At every 90 degree change of direction for horizontal line.
3. Every 50 feet of straight horizontal run.
4. Extend clean out to accessible surface. Do not place clean outs in carpeted floors. In such locations, use wall type clean outs.
5. Clean outs in piping outside building shall be extended to grade with adequate covers for planted or concrete areas.
6. Clean outs on rainwater lines shall be the same as sewer lines.
7. Provide clean out at connection of building piping to outside utility piping at 5'-0" outside of building.

E. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a P-trap in connection with a complete venting system so gasses pass freely to atmosphere with no pressure or syphon condition on water seal. Clean outs and plugs shall not be provided on P-traps.

F. Before piping is covered, Contractor shall test the piping installation in the presence of Architect, and Owners Representative, and correct leaks or defective work. Do not caulk threaded work.

1. Metal Pipe System - After backfilling and compacting of trenches is complete but before placing floor slab, fill waste and vent system to roof level with water, 10 feet minimum, and show no leaks for two hours. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

G. Vent entire waste system to atmosphere. Discharge vent piping 14 inches above roof. Join lines together in fewest practical number before projecting through roof. Locate vent lines so they will not pierce roof near an edge or valley.

H. Use torque wrench to obtain proper tension in cinch bands (above ground) when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

I. Flash pipes passing through roof in accordance with the requirements of Section 15101.

3.2 PIPE CLEANING:

A. After installation of new waste and vent piping systems entire waste and vent system shall be cleaned and flushed to insure no blockages occur. Submit planned cleaning and flushing program and schedule to college physical plant for approval before beginning.

END OF SECTION 15150

SECTION 15181 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install condensate drain piping as described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

PART 2 - PRODUCTS

2.1 MATERIALS

A. Condensate Drains
   1. Type M copper for condensate drains from air handling units.
   2. 3 inch deep seal, vented water trap adjacent to cooling coil connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains
   1. Support piping and protect from damage.

END OF SECTION 15181

SECTION 15182 - HYDRONIC PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SCOPE

A. Includes -
   1. Furnishing and installing the low temperature heating hot water system and specialties.

B. Related Sections -
   1. Sections 15010, 15051, and 15101 apply to this section.
   2. Control valves specified in section 15910.
   3. Pumps are specified in section 15130.

PART 2 - PRODUCTS

2.1 PIPE ALL SYSTEMS (ACCESSIBLE LOCATIONS)

A. Black steel schedule 40 pipe for heating supply and return for accessible locations.
   1. ASTM-A53
   2. ASTM-A106

B. Fittings
   1. Low temperature heating hot water system fittings shall be
      a. Steel 150 lb rated threaded for 2” and smaller or welded for 2-1/2” and larger.
      b. Flanges standard steel 150 lb.

2.2 PIPE ALL SYSTEMS (CONCEALED LOCATIONS)

A. Black steel schedule 80.

B. Fittings:
   1. Steel 300 lb rated welded fittings for all sizes.
   2. Provide isolation valves into and out of all concealed locations.

2.3 VALVES

A. Valves
   1. Provide on each valve a name plate showing manufacturer, valve size, grade, and pressure temperature service rating. Valve fluid bore shall match pipe size. All valves shall have renewable seats and discs, large deep stuffing boxes, packing glands and back seat on stem for repacking under pressure. Valves 1-1/2" and smaller shall be screwed or soldered connections. Valves 2" and larger shall be flanged.

B. Butterfly Valves -
   1. Operable in any quadrant, shall operate properly with flow in either direction, and fully suitable for throttling and tight shut-off service.
   2. Pressure drops at valve flows shall not exceed that for Centerline valves.
   3. 150 psi working pressure and -40 to 275 Deg F.
   4. Body - Ductile iron lug-wafer type with lugs tapped on both sides.
   5. Seat - EPT Nordel, rubber lined.

6. Stem -
   a. 304 or 316 stainless steel.
   b. Diameter not to be reduced at bearings.
7. Disc - Bronze or NDI (nylon coated ductile iron), bubble tight at 150 psig.
8. Bushings -
   a. Reinforced teflon, nylon, or olitie.
   b. Provide bearings at both ends of stems.
9. Operating Mechanisms - Infinite throttling handle with provision for locking in any position and with position stop.
10. Approved Manufacturers -
    a. Bray - Series 30
    b. Centerline - Series 200
    c. Crane - ›Monarch‹ Series
    d. Milwaukee - ML233E
    e. Norris/O‹Bannon - R Series
    f. Pratt - Model 2FII
    g. Watts BF-03
    h. Hammond
    i. Nibco Inc

C. Check Valves
1. Non-Slam Check Valves -
   a. Silent, spring loaded.
   b. 125 psi swp
   c. Silent, semi-steel body.
   d. Bronze trim and discs.
   e. Bronze seats with center guide and renewable with reseating with special tools.
   f. Guided spring.
   g. Operable in horizontal, vertical, angular, or upside down position.
   h. Approved Manufacturers -
      1) Bell & Gossett ITT or equal by
      2) Milwaukee
      3) Mueller
      4) Nibco Inc.

D. Ball Valves
1. Designed for shut off service.
2. Type 2, Class A rated at 150 lb steam working pressure and 350 deg F maximum temperature.
3. Two piece bronze body construction with full port, screwed end connections, and teflon seats.
4. Provide extended stem on insulated line.
5. Approved Manufacturers -
   a. ConBraco - Apollo - 70-100 or equal by
   b. Hammond
   c. Milwaukee
   d. Nibco
   e. Watt

E. Balancing Valves
1. Combination balancing valve and flow metering device with provision for connecting differential meter. Each meter connection shall have positive shut-off valves.

2. Valve shall be of non-ferrous construction and globe style design or proportional flow ball valve.
3. Valve shall be capable of being installed either direction in the flow and not affect flow measurement.
4. Unit shall -
   a. provide precise flow measurement.
   b. have precision flow balancing.
   c. have positive shut-off with no-drip seat.
5. Approved Manufacturer -
   a. Bell and Gossett
   b. Armstrong CBV
   c. Flow-set
   d. HCI

2.4 COCKS:

A. Gauge Cocks -
   1. Brass Tee Handle
   2. Approved Manufacturers -
      a. Ashcroft - 1092
      b. Ernst - 123
      c. Trerace - 865
      d. Walworth - 557

2.5 MANUAL AIR VENT BALL VALVE:

A. Designed for use as a high point vent.
B. Rated for 150 lb working pressure water, oil, gas, and steam.
C. Bronze body with solder end connections, teflon stem & seats, and bubble tight shut-off. 3/8 inch size with tee handle.
D. Approved Manufacturers -
   1. ConBraCo Appollo - 70-200.
   2. Hammond - 806
   3. Jenkins - 1100T
   4. Milwaukee - BA150-TH
   5. Nibco S580

2.6 COMBINATION BALL VALVE, HOSE CONNECTION, & CAP:

A. Approved Manufacturer -
   1. ConBraCo - Apollo 78-100

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 15101 for general piping installation procedures.
B. Install unions or flanges on downstream side of shut-off valves, specialty valves, and inlet and outlet to coils, pumps, and equipment.
C. Install thermometers on inlet and outlet of coils, pumps, and where shown on the drawings.

D. Install pressure gauges at pump suction and discharge as close as possible to the connections and where shown on the drawings.
E. Install balancing valves as shown on the drawings.
F. TESTING:
    1. Conduct tests in presence of Architect and before piping is covered.
    2. Tests shall be as described in Section 15101of the specifications.
G. Pipe cleaning shall be as specified in Section15188 Water Treatment.

END OF SECTION 15182

SECTION 15184 - REFRIGERANT PIPING & SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.
B. Related Sections
   1. Section 15084 - Refrigerant Piping Insulation

1.2 REFERENCES

A. American National Standards Institute / American Welding Society
   1. ANSI / AWS A5.8-92, 'Standard Specification for Brazing Alloys'
B. American Society For Testing And Materials
   1. ASTM A 36-97a, 'Standard Specification for Carbon Structural Steel'
   2. ASTM A 361-94, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding'
   3. ASTM B 280-98, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'

1.3 SUBMITTALS

A. Shop Drawings - Show each individual equipment and piping support
B. Quality Assurance / Control - Technician certificate for use of CFC and HCFC refrigerants

1.4 QUALITY ASSURANCE

A. Qualifications - Refrigerant piping shall be installed by a refrigeration contractor licensed by State and by technicians certified in use of CFC and HCFC refrigerants.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Refrigerant Piping
   1. Meet requirements of ASTM B 280, hard drawn straight lengths. Soft copper tubing not permitted.
   2. Do not use pre-charged refrigerant lines.
B. Refrigerant Fittings
   1. Wrought copper with long radius elbows.
   2. Approved Manufacturers -
      a. Mueller Streamline
      b. Nibco Inc
      c. Grinnell
      d. Elkhart
C. Suction Line Traps

1. Manufactured standard one-piece traps.
2. Approved Manufacturers -
   a. Mueller Streamline
   b. Nibco Inc
   c. Grinnell
   d. Elkhart

D. Connection Material
1. Brazing Rods in accordance with ANSI / AWS A5.8 -
   a. Copper to Copper Connections -
      1) Classification BCuP-4 Copper Phosphorus (6 percent silver).
      2) Classification BCuP-5 Copper Phosphorus (15 percent silver).
   b. Copper to Brass or Copper to Steel Connections - Classification BAg-5 Silver (45 percent silver).
   c. Do not use rods containing Cadmium.
2. Flux -
   a. Approved Manufacturers -
      1) Stay-Silv White Brazing Flux by J W Harris Co
      2) High quality silver solder flux by Handy & Harmon

E. Valves
1. Expansion Valves -
   a. For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
   b. Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
   c. Approved Manufacturers -
      1) Alco
      2) Henry
      3) Mueller
      4) Parker
      5) Sporlan
2. Manual Refrigerant Shut-Off Valves -
   a. Ball valves designed for refrigeration service and full line size.
   b. Valve shall have cap seals.
   c. Valves with hand wheels are not acceptable.
   d. Provide service valve on each liquid and suction line at compressor.
   e. If service valves come as integral part of condensing unit, additional service valves shall not be required.
   f. Approved Manufacturers -
      1) Henry
      2) Mueller
      3) Superior
      4) Virginia

E. Filter-Drier
1. On lines 3/4 inch outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
2. On lines smaller than 3/4 inch outside diameter, filter-drier shall be sealed type using flared copper fittings.

3. Size shall be full line size.
4. Approved Manufacturers -
   a. Alco
   b. Mueller
   c. Parker
   d. Sporlan
   e. Virginia

F. Sight Glass
1. Combination moisture and liquid indicator with protection cap.
2. Sight glass shall be full line size.
3. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
4. Approved Manufacturer -
   a. Alco AMI

G. Flexible Connectors
1. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
2. Approved Manufacturers -
   a. Anaconda 'Vibration Eliminators' by Anamet
   b. Vibration Absorber Model VAF by Packless Industries
   c. Vibration Absorbers by Superior Valve Co
   d. Style 'BF' Spring-flex freon connectors by Vibration Mountings

2.2 MATERIALS

A. Refrigerant Piping Supports
1. Base, Angles, And Uprights - Steel meeting requirements of ASTM A 36.
2. Securing Channels -
   a. At Free-Standing Pipe Support -
      1) Acceptable Manufacturers And Models -
         a) P-1000 Unistrut channels
         b) Hilti HS-158-12 channels
         c) Equal as approved by Architect prior to installation. See Section 01600.
   b. At Wall Support -
      1) Acceptable Manufacturers And Models -
         a) P-3300 Unistrut channels
         b) Hilti HS-1316-12 channels
         c) Equal as approved by Architect prior to installation. See Section 01600.
   c. At Suspended Support -
      1) Acceptable Manufacturers And Models -
         a) P-1001 Unistrut channels
         b) Hilti MS-41 channels
         c) Equal as approved by Architect prior to installation. See Section 01600.
3. Angle Fittings -
   a. Acceptable Manufacturers And Models -
      1) P-2626 90 degree Unistrut angle
      2) Hilti MW2 angle
      3) Equal as approved by Architect prior to installation. See

Section 01600.

4. Pipe Clamps -
   a. Acceptable Manufacturers -
      1) Hydra-Zorb
      2) ZSI Cush-A-Clamp
      3) Hilti Cush-A-Clamp
      4) Equal as approved by Architect prior to installation. See Section 01600.
5. Protective Cover - 18 ga steel, hot-dipped galvanized to meet requirements of ASTM A 361, 1.25 oz/sq ft.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines
   1. Install as high in mechanical areas as possible. Do not install underground or in tunnels.
   2. Slope suction lines down toward compressor one inch/10 feet. Locate traps at vertical rises against flow in suction lines.

B. Connections
   1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
   2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
   3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties
   1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
   2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
   3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
   4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports
   1. Support Spacing -
      a. Piping 1-1/4 inch And Larger - 8 feet on center maximum.
      b. Piping 1-1/8 inch And Smaller - 6 feet on center maximum.
      c. Support each elbow.
   2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
   3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
   1. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
   2. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
   3. Conduct tests at 70 deg F ambient temperature minimum.
   4. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
   5. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
   6. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION 15184

SECTION 15192 - NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Perform excavation and backfill required for work of this Section.
   2. Furnish and install gas piping and fittings to the relocated gas meter and from the meter to the pool heater.

B. Related Sections
   1. Division 02 -
      a. Procedure and quality of excavating, backfilling, & compacting
      b. Gas line extension main to relocated meter.
   2. Division 09 - Painting of exterior piping
   3. Section 15010 - General Mechanical Requirements

1.2 REFERENCES

A. American Society For Testing And Materials
   1. ASTM A 53-96, 'Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless'
   2. ASTM A 234-96b, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature Service'
   3. ASTM D 2513-96a, 'Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings'

1.3 QUALITY ASSURANCE

A. Qualifications
   1. Welders shall be certified and bear evidence of certification 30 days before commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority. See Section 15101
   2. Polyethylene pipe installers shall be properly trained and certified in procedure for joining polyethylene pipe.

1.4 DELIVERY, STORAGE, & HANDLING

A. Do not store polyethylene pipe so it is exposed to sunlight.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Valves
   1. 125 psi bronze body ball valve, UL listed

2. Approved Manufacturers & Models -
   a. ConBraCo - 'Apollo' series 80-100
   b. Jenkins - FIG-30-A
   c. Jomar - Model T-204
   d. McDonald - 3410
   e. Milwaukee - BCI-100T (with tee handle)
   f. PGL Corp - 'Red Cap' gas ball valve
   g. Watts - Model B-6000-UL

B. Seismic Shut-Off Valves
   1. Valves to automatically shut-off gas in event of earthquake.
   2. Provide with manual reset.
   3. Install valves between meter and building entrance.
   4. Approved Manufacturers
      a. Safe-T-Quake
      b. Trembler Tech
      c. Koso
      d. Prior approved equal

2.2 COMPONENTS

A. Above-Ground Pipe & Fittings - Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of ASTM A 53. Welded forged steel fittings meeting requirements of ASTM A 234 or standard weight malleable iron screwed.

B. Below-Ground Pipe & Fittings - Polyethylene pipe and fittings meeting requirements of ASTM D 2513 with No. 14 coated copper trace wire, or match existing underground piping material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel pipe installed through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.

B. Lay underground pipe in accordance with Manufacturer's recommendations and local gas utility company regulations and specifications.
   1. Provide 2 foot minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or compression fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
   2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
   3. Place 4 inches of sand around gas line buried underground.
   4. Do not install gas piping under building floor slabs-on-grade.

C. Install gas cocks on lines serving gas-fired equipment adjacent to equipment, on outside of equipment cabinet, and easily accessible.

D. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.

E. Use fittings for changes of direction in pipe and for branch runouts.

F. Install earthquake valve on downstream side of meter prior to pipe entering the

building.

3.2 FIELD QUALITY CONTROL

A. Site Tests - Before pipes are buried or concealed from view, test systems in Architect's presence at 60 psig for 4 hours and show no drop in pressure.

END OF SECTION 15192

SECTION 15410 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 SCOPE

A. Division 15010 and 15051 applies to this Section.
B. All sinks and lavatories shall have a shut-off valve on all water supply lines on the room side of the fixture. All valves must have a gasket seat, not a ground joint. Supply lines from the valve shall be 3/8" brass, chrome plated.
C. Interior exposed pipe, valves, and fixture trim shall be chrome plated.
D. Complete installation of each fixture including P-trap and accessories with accessible stop or control valve in each hot and cold water branch supply line.
E. Polish chrome finish at completion of Project.
F. Water closets and urinals shall have screwdriver stop valves on flush valves. Flush valves shall be of the exposed type.
G. Fixtures to be all of one type.
H. Floors shall slope to drains.
I. Roof drains shall have 36" x 36" pan and clamping collar. Dam on secondary roof drain shall be two inches above primary drain.
J. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point all edges.
K. Install fixtures and fittings as per local codes and Manufacturer's instructions. Fixtures shall be mounted level.
L. Do not use flexible water piping.
M. Provide fixture carriers for each fixture. Each carrier shall be of the proper type and size for fixture installed and installation location (wall or chase). Approved manufacturers are Wade, Smith, Josam, and Zurn.
N. All plumbing fixtures, trim and accessories in contact with the culinary water system shall comply with the requirements of ANSI/NSF 61 Section 9, (1998). Every box containing such component shall carry a notice of compliance including Testing Lavatory providing classification/certification and control number.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Water Closets: Wall Mounted Flush Valve Both Types
   1. Fixture
      a. American Standard - AFTWALL Water Saver 2257.103 Siphon Jet elongated bowl, 1-1/2" top spud.
      b. Kohler - Kingston K-4330-ET Siphon Jet elongated bowel 1-1/2" top spud.
      c. Eljer - Auburn water saver siphon jet 111-1405 with 1-1/2" top spud.
   2. Flush Valve lever operated exposed type ADA approved (model to match fixture)
      a. Sloan Royal
      b. Coyne Delany Flush Boy
      c. Zurn Aqua Vantage AV
B. Seat - (Provide split front type with check hinge)

1. Approved Manufacturers
    a. American Standard "Church"
    b. Crane Embassy
    c. Bemis
    d. Kohler
    e. Olsonite
    f. Beneke
    g. Spertzel

C. Lavatories: ADA Approved
1. Counter Top Fixtures -
    a. Size 20 by 17 inches maximum
    b. Approved Manufactures & Models -
        1) American Standard - Aqualyn 0476.028
        2) Eljer - Laura 051-0124
        3) Kohler - Pennington K-2195
2. Fittings -
    a. Faucet And Drain -
        1) Approved Manufacturers And Models -
            a) American Standard - 5402.142H
            b) Cambridge Brass - 21T143
            c) Chicago - 1802A-E3-369
            d) Eljer - 559-2010 with 803-0530 drain.
            e) Kohler - K-7404-5-A with K-16011 lever handle and K-13885 drain.
            f) Sanitary Dash - R7308
            g) Speakman - SC-3075-ADA
            h) T & S Brass - B-890
    b. Supply pipes with stops -
        1) Provide stuffing box and chrome plating.
        2) Approved Manufacturers And Models -
            a) Brass Craft - TCR 1912 A-CP
            b) Eastman - C 5M12-SBT-CP
    c. Traps -
        1) 17 ga tube 'P' trap, chrome plated
        2) Approved Manufacturers -
            a) Dearborn
            b) McGuire
            c) Sanitary Dash
    d. Safety Shields -
        1) Where McGuire traps are furnished, they shall be provided with factory installed insulation and covers.
        2) For supply stops and all other p-traps the following kits are approved:
            a) Trapwrap by Brocar Products
            b) Prowrap by McGuire Products
            c) Handi Lav-Guard by True Bro

D. Floor Drains
1. With chrome plated strainer and deep seal p-trap.
    a. Wade 1100 with 2450-t trap or equal by Josam, Smith or Zurn

E. Hose Bibb-
1. With vacuum breaker and loose key handle

2. Woodford Model 24P Polish Chrome finish or equal by
3. Chicago (Polish Chrome Finish)
4. Hammond (Brass Finish)

F. Roof Drains
1. Cast iron dome, 36" x 36" pan, clamping collar, roof sump receiver and. under deck clamp. Coordinate pan size and type with roofing manufacturer and use recommended size and materials if different than noted. Provide all other accessories necessary to install roof drains according to manufacturers recommendations and current code requirements,
2. Main Drain: provide with insulation extension
   a. Wade 3000 - with Cast Iron Dome
   b. Equals by Zurn, Smith or Josam are approved for bidding.
3. Secondary Drain: provide with insulation extension.
   a. Wade 3000 with 2" Dam mount top so Dam is 2" above lower roof elevation not the elevation of the bottom of recess. Cast Iron Dome
   b. Equal by Josam, Smith, or Zurn are approved for bidding.

G. Cleanouts:
1. Approved Types -
   a. Finish Floors - Wade W6000, Zurn A-1420-2, Smith 4023-T
   b. Resilient Flooring - Wade W6000-T, Zurn Z-1400-6, Smith 4140
   c. Finished Wall - Wade W8460-R-5, Zurn Z-1445-1, Smith 4530
   d. Exposed Drain Lines - Wade W8560A, Zurn Z-1440-A, Smith 4515
   e. General Purpose - Wade W8550A, Zurn Z-1440-a, Smith 4405

H. Downspout Nozzle
1. All nickel bronze body with decorative face of wall flange and outlet nozzle.
2. Approved types -
   a. Zurn Z-199 or equal by
   b. Wade
   c. Smith
   d. Josam

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install complete system in accordance with International Plumbing Code, 2003 ed.

END OF SECTION 15410

SECTION 15416 - DRINKING WATER COOLING SYSTEMS

PART 1- GENERAL

1.1. SUMMARY

A. Includes But Not Limited To
   1. Furnish and install drinking water cooling system units as described in Contract Documents.

B. Related Sections
   1. Section 15010 & 15051 - General Mechanical Requirements
   2. Section 15140 - Potable Water Piping System

PART 2- PRODUCTS

2.1 GENERAL

A. Interior exposed pipe, valves, and fixture trim shall be chrome plated.

B. Do not use flexible water piping.

2.2 MANUFACTURED UNITS

A. Handicap Accessible Semi-Recessed Bi-Level Fountain. (DF-1)
   1. Pressure drinking water cooler shall deliver at least 8.0 GPH (30.3 LPH) of water at 50°F cooled from 80°F inlet water and 90°F ambient.
   2. Front mounted push-button shall activate water flow through hooded bubbler having a non-squirt feature.
   3. An internally mounted adjustable stream regulator shall control water flow.
   4. Evaporator shall be tube-on-tube type and shall have both copper water and refrigerant coils encapsulated in insulation.
   5. R-134a refrigeration system shall be hermetically sealed and refrigerant flow shall be capillary tube controlled.
   6. An adjustable thermostat having an off position shall control refrigeration system.
   7. Stainless steel fountain shall have integral drain strainer.
   8. Potable water system components shall comply with the Safe Drinking Water Act Amendments and the 1988 Lead Contamination Control Act.
   9. Chilled water capacity shall be certified to ARI Standard 1010.
   10. Drinking water coolers shall comply with ANSI A117.1-1992 and ADA frontal approach requirements.
   11. Provide with high polished stainless steel finish.
   12. Approved Manufacturers and Models
      a. Acorn Aqua Contour A132408B-HP or equal by
      b. Elkay
      c. Oasis
      d. Haws
      e. Halsey Taylor
      f. Sunroc

PART 3- EXECUTION

3.1 INSTALLATION

A. Install fixtures with accessible stop or control valve.

B. Mounting
   1. Coordinate location of fountain with location and height of electrical outlet to ensure concealment of outlet by fountain.
   2. Handicap Accessible Single Fountain -
      a) Top surface to be mounted at height above floor to meet ADA requirements as instructed by manufacturer unless required otherwise by local code.
      b) Install 3/8 inch IPS union connection and Chicago No. 376 stop to building supply line.
      c) Install 1-1/4 inch IPS slip cast brass 'P' trap per fountain manufacturer's recommendations.

3.2 CLEANING

A. Polish chrome finish at completion of Project.

END OF SECTION 15416

SECTION 15671- AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Sections
   2. Section 15010 - General Mechanical Requirements

1.2 SYSTEM DESCRIPTION

A. Performance Requirements - EER rating as defined by ARI shall be not less than 13.5.

1.3 SUBMITTALS

A. Quality Assurance / Control
   1. Equipment check-out sheets
   2. Technician certificate for use of CFC and HCFC refrigerants

1.4 QUALITY ASSURANCE

A. Qualifications - Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of CFC and HCFC refrigerants.

B. Requirements of Regulatory Agencies - Each unit shall be UL labeled.

1.5 WARRANTY

A. Five year warranty on compressors from date of 'start-up'. Record 'start-up' date on warranty certificate for each unit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. McQuay International

B. Carrier

C. Prior approved equal.

2.2 UNIT DESCRIPTION

A. Provide and install as shown on the plans factory assembled, air cooled scroll compressor condensing units in the size and quantity specified. Each unit shall consist of hermetic tandem or triple scroll compressor sets, air-cooled condenser section, control system and all components necessary for controlled unit operation when field piped and wired to low side equipment specified elsewhere.

2.3 DESIGN REQUIREMENTS

A. General: Provide a complete scroll-compressor condensing unit as specified herein and as shown on the drawings. The unit shall be in accordance any local codes in effect.

B. Performance: Refer to the schedule of performance on the drawings. The unit shall be capable of stable operation to a minimum of 50 percent of full load without hot gas bypass. Performance shall be in accordance with ARI Standard 365-94.

C. Acoustics: Sound data shall be provided with the quotation. Test shall be in accordance with ARI Standard 370.

D. Condensing unit and air handling unit shall be provided by the same contractor and condensing unit and air handling unit DX coil shall be matched together.

2.4 CONDENSING UNIT COMPONENTS

A. Compressors: The compressors shall be sealed hermetic scroll type with crankcase oil heater and suction strainer. Compressor shall have a forced feed lubrication system with a reversible oil pump and oil charge. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads.

B. Condenser: The condenser coils shall consist of 3/8 inch (10mm) seamless copper tubes mechanically bonded into plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling coil shall be an integral part of the main condenser coil. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. They shall be equipped with a heavy - gauge fan guard. Fan motors shall be TEAO, three-phase, direct-drive, 1140 rpm.

C. Refrigerant Circuit: Capped connections shall be provided for field connection of refrigerant piping. Refrigerant specialties shall be field supplied and installed. Unit shall be provided with a factory mounted electronic hot gas bypass valve. Controls for the valve are to be done in the field by the ATC. Units 40 tons and larger are to have two independent circuits.

D. Control System: A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory short circuit protection of fan motors and control circuit, individual contractors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and unit power connections for connection to remote disconnect switch. Terminals shall also be provided for power supply to the evaporator heater circuit. Hinged access doors shall be tool-lockable. Barrier panels or separate doors are required to protect against accidental contact with line voltage when accessing the control system. Unit shall be enabled and staged by BAS. Factory mounted hot gas bypass valve shall also be controlled by BAS. Provide compatible terminal strip interface for staging of condensing unit. Provide temperature control board with the electronic hot gas bypass valve that is able to receive a 4-20 mA signal for discharge air setpoint.

E. The controller shall contain the following features as a minimum:

1. Equipment Protection: The unit shall be protected by alarms that shut the unit down and require manual reset to restore unit operation. Shut down

alarms shall activate an alarm signal to the BAS.

a. Shutdown Alarms
   1) Low evaporator pressure
   2) High condenser pressure
   3) Motor protection system
   4) Phase voltage protection (optional)
   5) Outside ambient temperature
   6) Sensor failures

b. Condenser Fan Control
   1) The unit controller shall provide control of condenser fans based on compressor discharge pressure.

c. Building Automation System (BAS) Interface
   1) Unit shall be enabled and staged by BAS (Johnson DDC) through terminal strip.

2.5 OPTIONS AND ACCESSORIES

A. The following options are to be included:
   1. Electric hot gas bypass to allow unit operation to 10 percent of full load.
   2. Non-fused disconnect switch with through the door handle
   3. Aluminum fins shall be pre-coated with a phenolic epoxy coating with 1000 hour salt spray rating (ASTM B117-90)
   4. Copper fin condenser coils
   5. Baked epoxy coating providing 3000+ hour salt spray resistance (ASTM B117-90) and is applied to both the coil and the coil frames.
   6. Spring vibration isolators for field installation.
   7. Rubber in shear vibration isolators for field installation.
   8. Hail and wind guards.
   9. High short circuit current protection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set condensing units level on roof on vibration isolation pads located at each corner of unit.
B. Do not use capillary tube and piston type refrigerant metering devices.
C. Install in strict accordance with manufacturer's requirements.
D. Provide all appurtenances required for a fully operational and functional unit.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service
   1. Condensing units shall be started up, checked out, and adjusted by Condensing Unit Manufacturer's authorized factory trained service mechanic. Instruct Owner in proper operation and maintenance.
   2. Use equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.
   3. Provide proper charge of refrigerant and oil.

END OF SECTION 15671

SECTION 15720 - FACTORY CUSTOM-BUILT AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Requirements of the following Division 15 Sections apply to this section:
   1. 15010 - AGeneral Requirements@.
   2. 15051 - ABasic Materials and Methods General Requirements@.

1.2 SUMMARY

A. This Section includes variable-volume, factory custom-built, air-handling units with coils, for indoor installations.

B. Related Sections: The following Sections contain requirements that relate to this section:
   1. Section 15070 AVibration, Noise Controls, & Seismic Protection@ for inertia bases, isolation pads, and vibration isolation hangers and supports.
   2. Section 15055 AMotors@
   3. Section 15861 "Air Filters"
   4. Section 15910 Automatic Temperature Controls
   5. Section 15940 "Sequence of Controls"
   6. Division 16 Electrical: Including but not limited to disconnects, circuit breakers, motor controllers and motor control centers, and variable frequency drives.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Section 15051 and Division 1 Specification Sections.
   1. Product data for each air-handling unit indicated, including the following:
      a. Certified fan performance curves with system operating conditions indicated.
      b. Certified fan sound power ratings.
      c. Certified coil performance ratings at
         1) system operating conditions indicated.
         2) half airflow and half water flow conditions.
      d. Motor ratings and electrical characteristics plus motor and fan accessories.
      e. Materials gages and finishes.
      f. Filters with performance characteristics.
      g. Dampers, including housings, linkages, and operators.
   2. Shop drawings from manufacturer detailing dimensions, required clearances, components, and location and size of each field connection.
   3. Coordination drawings for air-handling units in accordance with Section 15051.
   4. Wiring diagrams detailing wiring for power and controls and differentiating between manufacturer-installed wiring and field-installed wiring.

5. Product certificates signed by manufacturers of air-handling units certifying that their products comply with specified requirements.
6. Field quality control test reports specified in Part 3 of this Section.
7. Maintenance data for air-handling units for inclusion in Operating and Maintenance Manual.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA Standard 90A "Standard for the Installation of Air Conditioning and Ventilating Systems.@
B. ARI Certification: Air-handling units and their components shall be factory tested in accordance with the applicable portions of ARI 430 - Standard for Central-Station Air-Handling Units and shall be listed and bear the label of the Air Conditioning and Refrigeration Institute.
C. Manufacturers Qualifications: Firms regularly engaged in the manufacture of factory custom built air handling units of similar construction, size and duty as required by these contract plans and specifications for a period of not less than 10 years prior to the bid date of this project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.
B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.
C. Deliver air-handling units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.
B. Coordinate the size and location of structural steel support members.

1.7 EXTRA MATERIALS

A. Furnish one additional complete set of filters for each air-handling unit.
B. Furnish one additional complete set of belts for each air-handling unit.
C. Provide one drive change if required to meet installed conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Temtrol.
   2. Governair.
   3. Haakon
   4. Pace

2.2 MANUFACTURED UNITS

A. General Description: Factory assembled, consisting of fans, motor and drive assembly, coils, damper, plenums, filters, drip pans, and mixing dampers. Equipment must be fabricated and assembled in the USA.

B. All Air-handling units shall be a Blow-through configuration.

2.3 CASING

A. All walls shall be constructed of minimum (2) inch thick "double wall" acoustical thermal panels. The inner wall shall be a minimum of 22 gage, perforated galvanized steel. All units are required to maintain wall stiffness of 1/200th of an/inch at 1.5 times the working pressure. The insulation shall be 2 inch, 3.0 lb./cu ft. density fiberglass. All permanently joined flanged panel surfaces shall be sealed with an individual strip of tape sealer and caulked with a high grade silicone sealant. Wall (and roof) seams shall be turned inward to provide a clean flush exterior finish. All panel seams shall be sealed during assembly to produce an airtight unit. All wall and ceiling panels shall be designed with reinforcement for a negative 6@ wg static pressure on all panels on suction side of the fans and a positive 6@ wg pressure on the discharge side of the fans.

1. Frame & Panel Construction:
   a) Walls and roof of each unit shall have a support framework constructed of welded tubular steel to which all exterior and interior panels are mechanically fastened.
   b) Exterior wall panels shall be a minimum of 16 gage galvanized steel.
2. Standing Seam Panel Construction:
   a) The manufacturer shall make the exterior casing panels out of a minimum 14 gage galvanized steel, with the panel width not to exceed 24"each.
   b) The panels shall be constructed of heavier gauge steel, shorter panel widths, or angle iron stiffeners may be added as required to maintain casing deflection criteria of 1/200 at 1.5 times the working pressure. If panels cannot meet this deflection criteria, add additional internal reinforcing.

B. All insulation edges shall be protected from exposure to the air stream by the use of metal lagging if required to accomplish such.

C. Encapsulate fiberglass insulation with mylar.

D. AHU's shall ship as one single piece whenever feasible. If multiple sections are required, the units shall be engineered for simple demount and field assembly. Mounting frames of each section shall be fabricated with a flanged perimeter which is drilled with assembly clearance bolting holes and is continuously gasketed. Demount gaskets supplied with the unit shall be a high quality weather resistant closed cell neoprene sponge rubber. Assembly lugs, fabricated from structural steel with appropriate assembly clearance holes shall be welded to the base frame and color coded for ease of assembly. All gasket and necessary assembly hardware shall ship with the unit sections, boxed separately and clearly marked.

E. The AHU framework and casing construction shall be fabricated in such a manner as to comply with the following requirements:
   1. Provide an airtight unit that will not leak greater than 1% of the specified

airflow at the rated static pressures.

2. Access doors shall be provided of sufficient size to allow for removal of any components for replacement or repair such as fan wheels, shafts, motors, or coils, without structural degradation of the unit.

F. AHU-s shall be rated and pass a maximum 1% air leakage rate test. The AHU manufacturer shall conduct a cabinet air leakage test prior to shipping unit. Test results shall be submitted to the engineer prior to installation. Results shall be included in the O & M manuals.

1. The cabinet shall be tested at the unit design operating static pressures. Cabinet leakage is not to exceed SMACNA leak class 9 (or 1% of the specified air flow) on the operating air side of the unit.
2. Leak testing shall be performed by measuring the air flow into (or out of) the air handling unit at the designed operating static pressures. A chambered nozzle with a variable supply system, as described in AMCA STANDARD 210-85, must be used as the airflow measurement system.
3. All supply and return air openings are to be sealed along with the air seal at the supply fan to isolate the high and low side of the unit.
4. The airflow measurement system shall be ducted to the unit. The airflow pumped into (or out of) the unit is to be measured at the appropriate operating pressures.
5. The pressure drop across the chambered nozzle shall be measured with a manometer. The airflow will then be calculated using the AMCA STANDARD 210 equation 9.3.2.8 FLOW RATE FOR CHAMBER NOZZLES.

2.4 BASE CONSTRUCTION

A. Units shall be constructed from a minimum 2 X 5 X 10 gage tubular steel fitted with cross members to support all interior components. Frame to be continuously welded at all joints. Units less than or equal to 20 ft. long shall have a minimum 5 inch base, and units greater than 20 ft. shall have a minimum of 6 inch base.

B. A 12 gage tread plate or anti-slip surface floor shall be installed on the base. Floor shall be level, reinforced from below, with all seams continuously welded around the perimeter of floor. Floor shall be guaranteed not to leak with 2" inches of standing water. Base shall be provided with lifting lugs, minimum four (4) per unit section. The base shall be insulated with minimum 3 inch fiberglass insulation and sheeted with a 20 gage galvanized exterior steel liner.

C. Provide a 1.5 inch high perimeter collar around each floor opening.

D. Provide auxiliary drains in fan sections downstream of cooling coils and in mixing sections. Drain pans shall be 3" deep fabricated of 16 gage, 304 stainless steel with 1-1/4" MPT connections mounted <u>below</u> the bottom of the drain pan and the 20 gage subfloor of the unit. Drain pan shall be sloped to the outlet in the pan floor so as to prevent any standing water to accumulate in the drain pan. Stacked coils shall have intermediate drain pans with copper downspouts to the main drain pan. Units without such intermediate drain pans for stacked coils will not be accepted.

E. All drain connections on floor mounted air handling units shall terminate at the nearest floor drain.

2.5 ACCESS DOORS

A. Access doors shall be manufactured from 16 gage galvanized steel. The doors shall be double wall construction with 20 gage solid metal liner on the inside. Corners of the doors shall be continuously welded for rigidity. Two inch 3.0 lb./cu ft. density insulation shall be sandwiched between the 16 gage outer layer and the 20 gage inner layer. Door frames are to have thermal break allowing no through metal contact.

B. Two metal latches operable from either side of door shall be provided. Door opening shall be fully gasketed with continuous neoprene/EDPM rubber bulb type gasket rated for a constant exposure temperature range of -20°F to 160°F. All doors shall swing open against the AHU component section pressure unless leakage rate specified can be achieved otherwise. Doors shall have door tie backs to secure an open position. Door frames shall be made from 16 gage galvanized steel with the outside of the door flush with the unit. Minimum door opening size shall be 24 in. x 60 in. (where unit height permits).

2.6 FANS

A. Plug Fan (PF) SWSI Class III fans: Fan shall be single width inlet arrangement plenum fan as indicated on the schedule. Fan blades shall be hollow airfoil in shape, welded to the center. All wheel side plates, fan wheel, and housing shall be fully welded. Fan bearings shall be heavy duty, pillow block, self-aligning ball type (roller bearings for all 33" diameter and greater fans). Bearings shall be selected for a minimum L-50 life (200,000) hours at maximum horsepower and operating speed for classification. Both bearings shall have the same bore, type and manufacturer. Rigid supports for both must be removable for access to the wheel. Inlet cone shall be precision spun. Provide inlet screen made of minimum 1/8 inch diameter steel rods arranged into a circular grid pattern with interwoven radial spokes. Fan shaft shall be turned, ground and polished solid steel rated at maximum RPM below critical speed. Fan wheel and sheaves shall be keyed to the shaft. Fan shall be IRD balanced at design RPM to a vibration velocity less than or equal to .080 inches per second measured at each bearing pad prior to shipment with motor, sheaves and belts in place. Fan shall be rated in accordance with AMCA 300 for sound. Fan wheel manufacturer shall be New York Blower, Chicago Blower, Pace or Woods.

B. Variable volume fans speed shall be controlled by variable frequency drives (VFD) as furnished and installed by Division 16.

C. Provide a metal belt guard having sides of galvanized steel and expanded metal face with openings for fan tachometer readings. Belt guard shall be sized to allow either sheave to be increased by two sizes. Interlocking door "kill" switch, factory mounted, can be furnished in lieu of a belt guard or fan screen. Field wiring of kill switch to any remote mounted starting equipment shall be done by the mechanical contractor.

D. An I-beam shall be factory installed at the roof, inside the AHU casing, above the motor for any motor 15 HP or greater. This I-beam shall serve as a permanent device from which the motor can be lifted from its mounting position by cable or chain and then easily moved to the access door for removal from the AHU.

2.7 VIBRATION ISOLATION

A. An integral all welded steel vibration isolation base shall be provided for the fan and motor.
B. Seismic certified spring isolators shall be free standing with sound deadening pads and leveling bolts.
C. Spring diameter to compressed operating height ratio shall be 1 to 1.
D. Spring deflection shall be 2 inch.
E. Isolators shall have integral seismic restraints. If isolators are not a seismic rated assembly, then the restraint device must be approved and stamped by a licensed engineer duly registered in the state of the project site.

2.8 MOTORS

A. See Section 15055.
   1. Bases: Adjustable.
   2. Bearings: The following features are required:
      a. Ball or roller bearings with inner and outer shaft seals.
      b. Grease lubricated.
      c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
   3. Enclosure Type: The following features are required:
      a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
      b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
   4. Overload protection: Built-in, automatic reset, thermal overload protection.
   5. Noise rating: Quiet.
   6. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.
B. Starters, Electrical Devices, and Wiring: Electrical devices and connections to comply with Division 16.

2.9 COILS

A. Coils shall be fully enclosed within casing and mounted on primed with Zinc rich chromate primer and painted angle iron or stainless steel racks manufactured to allow coils to slide out individually.
B. Removable coil access panels shall be provided to remove coils through casing wall. Coils shall be individually removable towards (away from) the access side.
C. Drain pans shall be 16 gage, 304 stainless steel. Intermediate drain pans shall be interconnected with 1 inch copper drain lines.
D. Coils shall be designed for direct expansion refrigerant service with a minimum 5/8" diameter tubing. Maximum fpi shall be 11.
E. Coils shall be certified in accordance with ARI Standard 410.
F. Coils shall be hydrostatically tested at 400 Psig, and shall be suitable for working pressures and temperatures up to 200 Psig and 220 degrees F. Coil tube thickness shall be 0.035 inch minimum thickness. Fin thickness shall be 0.008 inch minimum. Coils must have brazed U-bend return bends. Hairpin construction type coils will not be accepted.

G. Pipe connections shall be on the same end, and shall be threaded.
H. Coils indicated as being cleanable shall have either a cleanout plug for each tube or shall have a gasketed removable header cover.
I. Coil face velocity shall not exceed 500 FPM.
J. Coils with turbulators will not be accepted.

2.10 FILTERS

A. Filters: As per Section 15861.
B. Filters shall be installed in a prefabricated channel rack.
C. Filters shall be lift-out where access is available upstream of the filter, or side out when access is not available.

2.11 FILTER GAGES

A. Provide Dwyer 2000 magnehelic gages factory installed on casing of AHU.
B. Magnehelic gages shall be accurate to ±2% of full range.
C. Sensing probes and shut off valves shall be provided for each gage.
D. One gage shall be provided for each filter bank.

2.12 FINISH

A. Unit shall be finished painted with two component etch bond primer and finish painted with alkyd enamel, color as selected by Architect. All uncoated steel shall be painted with red oxide primer. All metal surfaces shall be painted with vinyl wash primer to ensure paint bond to metal. Bright spangled galvanized finish is acceptable in lieu of painted finish.

2.13 LIGHTS

A. Marine lights with protective metal cage, glass seals and bulbs, complete with duplex receptacles shall be installed on the wall across from the access doors. A switch with an indicator light shall be installed on the unit. Electrical power shall be 120/1/60.

2.14 DAMPERS

A. Dampers and frames shall be made from 14 gage galvanized steel or extruded aluminum. Dampers shall be airfoil style. Maximum blade length shall be 48 inches. Maximum blade width shall be 6 inches.
B. Drive shafts shall be made with 2" inch min. square stainless steel mounted in nylon bearings for a positive no-slip control through clamps. Round shafts with set screws to secure linkage or hex shafts are not acceptable. The damper linkage shall be outside of the air stream. Linkage shall be located at each side of damper blades with positive non-slip clamping at each damper shaft.
C. Blade seals shall be PVC suitable for -40 degrees F. air temperatures.
D. Jamb seals shall be stainless steel.
E. Jack shaft assemblies shall be provided for multiple damper installations.
F. Position damper parallel blades so that return air and outside air streams are directed toward each other to promote better mixing of the air.
G. Damper actuators to be supplied by the ATC contractor. Specified torque

requirements for each damper assembly shall be coordinated with the ATC contractor to ensure a sufficient quantity and size of actuators is used to provide a complete shut-off of the dampers.

2.15 ELECTRICAL SERVICE

A. The unit shall have factory installed conduit and wiring to a single point in the field exterior to the AHU casing, for the power wiring circuit, and the 120 Volt Service Circuit.
B. All wiring and components shall comply with the current National Electrical Code and Division 16.
C. Provide a 120/1/60 service outlet inside unit.
D. Wire the Anti-Microbial Growth suppression System in series with the service outlet.
E. Unit shall be ETL listed and labeled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of air-handling units.
B. Examine rough-in for electrical service and steam, hydronic, and condensate drain piping to verify actual locations of connections prior to installation.
C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install air-handling units level and plumb, in accordance with manufacturer's written instructions. Maintain manufacturer's recommended clearances.
   1. Support floor-mounted units on concrete equipment bases. Secure units to anchor bolts installed in concrete equipment base.
B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.3 EQUIPMENT BASES

A. Construct concrete equipment pads as follows:
   1. Coordinate size of equipment bases with actual unit sizes provided. Construct base 4 inches larger in both directions than the overall dimensions of the supported unit.
   2. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.
   3. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing units. Provide #4 rebar at 12" O.C. both ways.
   4. Place concrete and allow curing before installation of units. Use Portland Cement conforming to ASTM C 150, 4,000 psi compressive strength, and normal weight aggregate.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties. The following are specific connection requirements:
   1. Arrange piping installations adjacent to units to allow unit servicing and maintenance.
   2. Connection piping to air-handling units with flexible connectors.
   3. Connect condensate drain pans using Type L copper tubing. Extend to the nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

B. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

C. Electrical Connections: The following requirements apply:
   1. Electrical power wiring is specified in Division 16.
   2. Temperature control wiring and interlock wiring is specified in Division 15 Section "Control Systems."
   3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:
   1. Inspect the field assembly of components and installation of air-handling units including piping, ductwork, and electrical connections.
   2. Prepare a written report on findings and make recommended corrective actions.

3.6 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust water coil flow, with control valves to full coil flow, to indicated gpm.

B. Adjust damper linkages for proper damper operation.

C. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face.

3.7 START UP

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
   1. Remove shipping, blocking, and bracing.
   2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
   3. Perform cleaning and adjusting specified in this Section.
   4. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

6. Set zone dampers to full open for each zone.
7. Set outside-air and return-air mixing dampers to minimum outside-air setting.
8. Comb coil fins for parallel orientation.
9. Install clean filters.
10. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full-open position.
11. Disable automatic temperature control operators.

B. Starting procedures for air-handling units:
1. Energize motor, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
a) Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.8 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals.

B. Schedule training with at least 7 days' advance notice.

END OF SECTION 15720

SECTION 15801 - GENERAL DUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. General procedures and requirements for ductwork.
   2. Repair leaks in ductwork, as identified by smoke test, at no additional cost to Owner.

B. Related Sections
   1. Division 09 - Quality of acoustic sealant
   2. Division 15 - Air test and balance and smoke testing of ductwork
   3. Section 15010 - General Mechanical Requirements

1.2 SUBMITTALS

A. Samples - Sealer and gauze proposed for sealing ductwork.

B. Quality Assurance / Control
   1. Manufacturer=s installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.
   2. Specification data on sealer and gauze proposed for sealing ductwork.

1.3 QUALITY ASSURANCE

A. Requirements - Construction details not specifically called out in this Section shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.

PART 2 - PRODUCTS

A. Finishes Where Applicable - Colors as selected by Architect.

B. Duct Hangers
   1. One inch by 18 ga galvanized steel straps or steel rods as shown on drawings, and spaced not more than 96 inches apart. Do not use wire hangers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.

B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.

C. Hangers And Supports
   1. Install pair of hangers close to each transverse joint and elsewhere as required by spacing indicated in table on Drawings.

2. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
3. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.

3.2 CLEANING

A. Clean interior of duct system before final completion.

END OF SECTION 15801

SECTION 15812 - ROUND STEEL DUCTWORK

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Ducts -
   1. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80, "Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with Type G coating.
   2. Use of aluminum or non-metal ducts is forbidden.
   3. Duct shall be constructed to SMACNA Pressure Class 2" to 2" standards.

B. Joints
   1. Mechanical type joints shall be sealed with duct sealer as specified in section 15820.
   2. Welded joints are acceptable.
   3. Joints shall be as recommended in SMACNA HVAC Duct Construction Standards for round duct.

C. Fittings:
   1. Ducts shall be provided with 45 and 90 degree elbows of 2 piece die stamped construction.

D. Ductwork shall be shop fabricated or spiral ductwork manufactured by a manufacturer regularly engaged in the manufacture of this type of ductwork. Ductwork shall meet all requirements of SMACNA and manufacturer be prior approved.

E. <u>All exposed ductwork shall be spiral round duct with a galvanized finish. Exposed ductwork shall have an internal perforated liner. See section 15813.</u>

F. Where concealed, standing seam duct may be used in lieu of spiral duct if properly constructed for velocity and pressures encountered.

G. Duct take-offs and volume dampers. See Section 15820.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Ducts
   1. Straight and smooth on inside with joints neatly finished unless otherwise directed.

END OF SECTION 15812

SECTION 15813 - MEDIUM VELOCITY DUCTWORK

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Division 01 General and Section 15010 and 15051 are part of this section.

1.2 SCOPE

A. Provide and install medium pressure round and/or flat oval duct and fittings meeting SMACNA pressure class 2" and 3" standards.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. Supply air ductwork shown upstream of VAV boxes shall be spiral acoustical duct consisting of an externally pressure-tight metal sheet, a layer of fire resistant fiber glass insulation, an internal liner next to the air flow and a perforated galvanized steel liner. All fittings shall have solid, perforated steel liners. All other round above grade supply and return air ductwork as described in Section 15812 shall be wrapped with insulation.

B. Equal to United Sheet Metal Acoustic K-27.

C. Manufacturers shall be those regularly engaged in the manufacturers of this product. Approved manufacturers, United Sheet Metal, Dee-s, Metco, or prior approved equal.

D. As an alternative standing seam ductwork may be used in leiu of spiral duct as long as it is constructed for velocity and pressures encountered.

E. Joint Sealer as specified in section 15820 or as recommended by duct system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Duct installation and sealing shall be in strict accordance with SMACNA HVAC duct construction standards and HVAC air duct leakage test manual.

END OF SECTION 15813

SECTION 15816 - STEEL DUCTWORK

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Furnish and install the 2" to 2" wg ductwork and related items specified below and shown on the Drawings.
   2. Ductwork shall be installed in strict accordance with SMACNA Standards (latest edition) for exterior installation.

B. Related Work Specified Elsewhere -
   1. General Division 01 and Section 15010 and 15051 are a part of this Section.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL -

A. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80 with Type G coating.

B. Use of aluminum or non-metal ducts is forbidden.

PART 3 - EXECUTION

3.1 DUCTS -

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.

B. Duct panels through 48 inch dimension having acoustic duct liner need not be crossbroken or beaded.

C. Brace and install ducts so they shall be free of vibration under all conditions of operation.

D. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.

E. Ducts shall be large enough to accommodate inside acoustic duct liner.

F. Install internal ends of slip joints in direction of flow. Make joints air tight using duct sealer as specified in section 15820.

G. Paint duct the color approved by an architect.

H. Install flexible inlet and outlet duct connections to air handlers and exhaust fans.

I. Provide each duct take-off with an adjustable volume damper to balance that branch -
   1. Anchor dampers securely to duct.
   2. Install dampers in main ducts within insulation.
   3. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

J. Install grilles and diffusers.

3.2 AIR TURNS -

A. Permanently installed, consisting of curved metal blades or vanes arranged to permit air to make abrupt turn without appreciable turbulence, in elbows of supply and above ground return ductwork.

B. Air turns shall be quiet and free from vibration when system is in operation.

END OF SECTION 15816

SECTION 15818 - FLEXIBLE DUCT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Includes But Not Limited To -
   1. Supply air branch duct runouts to diffusers where indicated on Drawings.

B. Related Work Specified Elsewhere -
   1. Volume dampers and sheet metal duct specified in Section 15812 and 15820.

1.2 RELATED SECTIONS

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Ducts -
   1. Formable, flexible, circular duct which shall retain its cross-section shape, rigidity, and shall not restrict air flow after bending.
   2. Nominal 1-1/2 inches thick, 3/4 lb/cu ft density fiberglass insulation with air-tight, see-through polyester core, sheathed in seamless vapor barrier jacket factory-installed over flexible assembly.
   3. Each individual component in assembly as well as entire assembly, including insulation, ductwork and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   4. Approved Manufacturers -
      a. Flexmaster
      b. Thermaflex
      c. Wiremold

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 3'-0" maximum lengths.

END OF SECTION 15818

SECTION 15819 - DUCTWORK TESTING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURE

A. All ductwork shall be tested prior to concealing or other work which may prevent repair of ductwork. Refer to "Inspection Notice", Section 15051.

B. Duct testing shall consist of pressurizing the duct system either with the main blower or in sections using a portable blower. Each portion of ductwork to be tested shall be sealed at all openings. The ductwork shall be subjected to an internal pressure not less than 2" W.G or 1-1/2 times working pressure whichever is larger. All ductwork shall be surveyed for audible leaks, and structural stability. Leaks shall be sealed, weak joints repaired, vibrations eliminated. A log shall be kept by the contractor indicating date, conditions, repairs made, and name of individual(s) performing the test. A copy of the log shall be retained for possible observation at the request of the Owner or architect. Ductwork shall maintain test pressure with not more than 10% variation over the period of the test.

END OF SECTION 15819

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements
   2. Section 15920 - Temperature control dampers actuators and actuator linkages

1.2 REFERENCES

A. American Society for Testing and Materials.
   1. ASTM A 653-96, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'
   2. ASTM C 665-96, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing'
   3. ASTM C 1071-91, 'Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)'

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Flexible Equipment Connections
   1. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
   2. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 200 deg F.
   3. Approved Manufacturers -
      a. Cain - N-100
      b. Duro Dyne - MFN
      c. Elgen - ZLN
      d. Ventfabrics - Ventglas

B. Duct Access Doors
   1. Factory built insulated access door with hinges and sash locks. Construction shall be galvanized sheet metal, 24 ga minimum.
   2. Fire and smoke damper access doors shall have a minimum clear opening 12 inches square to easily service fire damper.
   3. Approved Manufacturers -
      a. AirBalance - Fire/Seal FSA 100
      b. Cesco-Advanced Air - HAD-10
      c. Elgen - Model 85 A
      d. Flexmaster - Spin Door
      e. Kees Inc - ADH-D

f. Pottorff - 60-HAD
g. Ruskin - ADH-24
h. Safe-Air - SAH

C. Dampers & Damper Accessories
1. Concealed Ceiling Damper Regulators -
a. Approved Manufacturers -
1) Cain
2) Duro Dyne
3) Metco Inc
4) Vent-Lock - 666
5) Young - 301
2. Volume Dampers -
a. Factory-manufactured 16 gauge galvanized steel, single blade and opposed blade type with 3/8 inch axles and end bearings. Blade width 8 inches maximum. Blades shall have 1/8 inch clearance all around.
1) Damper shall operate within acoustical duct liner.
2) Provide channel spacer equal to thickness of duct liner.
b. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
c. Approved Manufacturers -
1) American Warming
2) Arrow
3) Cesco
4) Daniel
5) Greenheck
6) Pottorff
7) Ruskin
8) UTEMP
9) Safe-Air

D. Air Turns
1. Single thickness vanes with one inch trailing edge. Double thickness vanes not acceptable.
2. 4-1/2 inch wide vane rail. Junior vane rail not acceptable.

E. Branch Tap for Round and Flexible Ductwork (High efficiency type)
1. Factory-manufactured rectangular-to-round or round-to-round 45 degree leading tap fabricated of 24 ga zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 653, with G-90 coating.
2. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
3. Manual Volume Damper -
a. Single blade, 22 ga minimum
b. 3/8 inch minimum square rod with brass damper bearings at each end.
c. Heavy duty locking quadrant on 1-1/2 inch high stand-off mounting bracket attached to side of round duct.
4. Approved Models & Manufacturers -
a. HETD-L by Daniel Manufacturing

b. STO by Flexmaster USA Inc
c. HET by Sheet Metal Connectors Inc
d. Prior approved equal

F. Duct Sealer
1. Approved Products
a. Duct Butter or Butter Tak by Cain Manufacturing Co. Inc.
b. DP 1010 by Design Polymeric
c. S2 by Duro Dyne
d. Versa Grip 102 by Hardcast Inc.
e. 15-325 by Kingco, King Adhesive Corp.
f. 44-41 by Mon-Eco Industries Inc.
g. Airseal #11 by Polymer Adhesive Sealant Systems Inc.
h. Multipurpose Duct Sealer by United McGill Corp.
i. Water Base Duct Sealer by United McGill Corp.

2.1 FABRICATION

A. Air Turns
1. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
2. Quiet and free from vibration when system is in operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible inlet and outlet duct connections to each vav box, exhaust fan, and air handling unit.
B. Access Doors In Ducts
1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches of installed dampers.
2. Install within 6 inches of fire dampers and in Mechanical Room if possible.
C. Dampers & Damper Accessories
1. Install concealed ceiling damper regulators.
a. Paint cover plates to match ceiling tile.
b. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
2. Provide each take-off with an adjustable volume damper to balance that branch.
a. Anchor dampers securely to duct.
b. Install dampers in main ducts within insulation.
c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
d. Where concealed ceiling damper regulators are installed, provide cover plate.
D. Install motorized dampers.

END OF SECTION 15820

SECTION 15822 - ACOUSTICAL DUCT LINER

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Acoustical lining of all rectangular supply and return air ductwork -

B. Insulation materials, adhesives, coatings, and other accessories shall have surface burning characteristics as determined by ASTM E 84 not to exceed 25 for flame spread and 50 for smoke developed. Flame proofing treatments subject to deterioration due to the effect of moisture or high humidity are not acceptable.

1.2 Duct dimensions shown on drawings are for inside of duct liner and does not include liner insulation.

1.3 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 DUCT LINER -

A. One inch thick, 1-1/2 lb density fiberglass.

B. Approved Manufacturers -
   1. CSG Ultralite OR Tough guard
   2. Johns-Manville Lina-Coustic
   3. OCF Aeroflex
   4. Knauf Type M

2.2 ADHESIVE -

A. Approved Water-Based Products
   1. Cain - Hydrotak
   2. Design Polymerics - DP2501 or DP2502 (CMCL-2501)
   3. Duro Dyne - WSA
   4. Hardcast - IA-901
   5. Kingco - 10-568
   6. Miracle - PF-101
   7. Mon-Eco - 22-67
   8. Polymer Adhesive - Glasstack #35
   9. Techno Adhesive - 133
   10. United McGill - Uni-tack

2.3 MECHANICAL FASTENERS -

A. Conform to Mechanical Fastener Standard MF-19/1.

B. Pins that attach to ductwork with adhesives are not allowed.

C. Approved Manufacturers -
   1. Duro Dyne

2. Omark dished head "Insul-Pins"
3. Grip nails may be used if each nail is installed by "Grip Nail Air Hammer" or by "Automatic Fastener Equipment" in accordance with Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with a continuous 100% coat of adhesive and with mechanical fasteners spaced as shown on drawings. Pin all duct liner.
B. Accurately cut liner and thoroughly coat exposed edges of duct liner, including diffuser drop cut-outs with adhesive to seal fibers. Butt joints tightly. Top and bottom sections of insulation shall overlap sides.
C. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty.
D. If insulation is installed without horizontal, longitudinal, and end joints butted together and properly treated, installation will be rejected and work removed and replaced with work that conforms to this specification. See drawings for detail of joint treatment.

END OF SECTION 15822

SECTION 15836 - EXHAUST FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install exhaust fans as described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies - Bear AMCA seal and UL label.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Ceiling Mounted Exhaust Fans -
   1. Acoustically insulated housings. Sound level rating of 4.6 sones maximum for fan RPM and CFM listed on Drawings.
   2. Include chatterproof integral back-draft damper with no metal to metal contact.
   3. True centrifugal wheels.
   4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
   5. Suitably ground motors and mount on rubber-in shear vibration isolators.
   6. Provide wall or roof cap, as required.
   7. Approved Manufacturers -
      a. Breidert
      b. Carnes
      c. Cook-Gemini
      d. Greenheck Sp
      e. Pace
      f. Penn Zephyr

2.2 ACCESSORIES

A. Curbs for Roof-Mounted Exhaust Fans
   1. Insulated, pre-fabricated metal roof curb for roof configuration shown on Drawings.
   2. Approved Manufacturers -
      a. Sound Attenuating Curbs -
         1) Penn
         2) Carnes
         3) Breidert
         4) Greenheck
         5) Jenn-Air
         6) Acme

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or to curb.

END OF SECTION 15836

SECTION 15841 - PRESSURE INDEPENDENT VAV BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units
B. Integral heating coils.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Box linkage, actuators, controllers etc that interface with the ATC contractor shall be furnished and installed under section 15910.

1.3 RELATED SECTIONS

A. Section 15910 - Automatic Temperature Controls
B. Division 16 - Equipment Wiring Systems: Electrical supply to units.

1.4 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
B. UL 181 - Factory-Made Air Ducts and Connectors.
C. ARI 880 - Air-Conditioning and Refrigeration Institute Standard Rating Conditions for Air Terminals
D. ASTM A 527 (Steel Sheet, Zinc Coated Galvanized)
E. NFPA 90A, Lining

1.5 SUBMITTALS

A. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.
B. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and radiated sound power levels (2nd through 7th octave bands) at design maximum operating conditions. Also submit Radiated Sound NC values ARI 885-90.
C. Submit manufacturer's installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data provide to mechanical contractor for inclusion in O & M Manual see Section 15010.
B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data.
C. Include directions for resetting all pneumatic and electronic controls.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years experience.

1.8 WARRANTY

A. Provide one year manufacturer's parts warranty from date of acceptance of system.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. VAV Terminal Units

1. General
   a) VAV terminal units shall be pressure independent with electric controls.
   b) Unit casings shall be a minimum of 20 gauge galvanized steel for units up to 8", 18 gauge for unit sizes 12" and 16 gauge for units over 12".
   c) Units shall have round inlets with round or square outlets as shown on drawings and shall have a 2" inlet duct collar for field connection.
   d) Damper blade shall be of elliptical shape and operate on a 45° arc. Blade shall be a minimum of 16 gauge galvanized with heavy duty extruded neoprene gasket to seal off air leakage not to exceed 2% of the terminal rated CFM at 3" of inlet static pressure. Blade shaft shall pivot on corrosion free oil lite bearings. 90° rotation, single blade dampers are not acceptable.
   e) Entire terminal unit shall be factory assembled with electric controls. Metal assemble shall be mechanically sealed and fastened.
   f) Flow measuring taps and flow chart shall be furnished with each unit for ease of field setting or changing of air flows. All controls shall be easily accessible for field adjustments without having to remove any of the terminal casing or any access panels.
   g) Sound data shall be compiled from testing in an ADC independent certified laboratory and in accordance with ARI standard 880.
2. Controls
   a) Manufacturer shall factory mount DDC controls supplied by the controls contractor.
   b) The unit shall have a Differential pressure airflow sensor which traverses the duct using the equal cross sectional area or log-linear traverse method along two perpendicular diameters located across the inlet. The sensor will provide a differential pressure signal amplified to equal 3 times the velocity pressure with an accuracy of at least "10% throughout the range of 350 to 2600 fpm inlet duct velocity.
3. Accessories
   a) Hot water heating coil:
      1) Coil shall be mounted in a minimum 20 gage galvanized steel casing with slip and drive discharge connections, and factory mounted on the base unit as shown on the equipment drawings, Coils shall have:

2) Aluminum fins bonded to the copper tubes by mechanical expansion.
3) Number of coil rows and circuits shall be selected to provide performances as required by the plans.
4) Up to 4 rows as shown on equipment drawings or designed on the equipment schedule. Right or left-hand fittings with sweat connection sizes as indicated on equipment drawings.

4. Approved Manufacturers
   a) Redd-i IDC
   b) Titus
   c) Trane
   d) Carrier
   e) Price

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design air flow to 25 percent nominal air flow Set units with heating coils for minimum 30 percent full flow.

END OF SECTION 15841

SECTION 15851- DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 MAINTENANCE

A. Extra Materials - Leave tool for removing core of each different type of grille for building custodian.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, Registers and Grilles
   1. Finish - As scheduled on drawings
   2. Removable core.
   3. Model - as scheduled on drawings.
   4. Approved Manufacturers -
      a. Carnes
      b. J & J
      c. Krueger
      d. Metalaire
      e. Price
      f. Titus
      g. Tuttle & Bailey
      h. Agitair
      i. Anemostat
      j. Barber Colman
      k. Environmental Air Products
      l. Air Control Products
      m. Nailor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side.

END OF SECTION 15851

SECTION 15855 - PENTHOUSE VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install the roof mounted penthouses as scheduled in Contract Documents.

B. Related Sections
   1. Section 15010 - General Requirements

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Penthouse
   1. Penthouse type of extruded aluminum complete with roof curb and 1/2 inch mesh 16 gauge aluminum bird screen.
   2. Finish shall be anodized aluminum.
   3. Approved Manufacturers -
      a. Tiered Type - Model TRE extruded aluminum ventilator by Loren Cook Company,
      b. Louvered Penthouse -
         1) Model RLX by Breidert Co
         2) Model GLAB by Carnes Company
         3) Model WRH by Greenheck Fan Corporation
         4) Model MPH by Jenn-Air Industries Inc

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Manufacturer's recommendations.

END OF SECTION 15855

SECTION 15861 - AIR FILTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install filters used in mechanical equipment.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Air Handling Unit Filters
   1. 2 inch thick, medium efficiency, disposable type pre-formed pleated design, having at least 4.5 sq ft of filtering media per sq ft of face area.
   2. Media shall be reinforced non-woven cotton fabric, treated with adhesive similar to 'Vyclad B' and continuously laminated to supporting steel wire grid conforming to configuration of pleats.
   3. Media pack shall be sealed in a chipboard frame or beverage board.
   4. Filters shall have rated average efficiency of 25 to 30 percent on ASHRAE Test Standard 52-76 and be capable of operating with variable face velocities up to 500 FPM without impairing efficiency.
   5. Initial resistance shall not exceed 0.30 inches w.g. at 500 FPM or 0.14 inch w.g. at 300 FPM. Filter shall be listed Class 2 by UL.
   6. Approved Manufacturers -
      a. DP2-40 by Air Guard
      b. E35H by Eco-Air Products Inc
      c. HC Type 40 by Envopleat
      d. Type 30/30 by Farr Co
      e. Mark 80 by Serv-Aire

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide ample access for filter removal.

3.2 FIELD QUALITY CONTROL

A. Inspection - At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION 15861

SECTION 15910 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. All pertinent sections of Section 15000, Division 15, are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

1.2 SCOPE OF WORK:

A. The scope of work shall include all labor, material, and equipment necessary to complete the temperature control work for the entire project.

B. The Building Automation System (BAS) in the Activity Center shall be an extension of the existing Johnson Controls Metasys campus BAS. Integrate the new local controllers with the existing system for remote monitoring and control. The BAS shall incorporate Direct Digital Control (DDC) for equipment and direct communication to the Central Operator Workstation for remote monitoring and control.

C. This contractor shall carefully review all notes, coordination schedules, and drawings for work required under this section of the specification.

D. Adjustment and validation of control system. Instruction of Owner's representative on maintenance and operation of control equipment.

E. Composite diagrams showing interlocks between equipment furnished under this and other sections.

F. This system shall include but not be limited to controls and equipment for the Activity Center as hereinafter specified:
   1. VAV Air Handlers - new
   2. VAV Boxes

1.3 EXECUTION:

A. Related Work in Other Sections:
   1. Examine all sections for work related to work of this section, principal items of which are:
      a. Finished - Division 9
      b. Mechanical - Division 15
      c. Electrical - Division 16
   2. The following incidental work shall be furnished by the designated contractor under the supervision of the Temperature Control Contractor:
      a. The Mechanical Contractor shall:
         1) Install automatic valves, and separable wells that are specified to be supplied by the temperature control contractor.
         2) Furnish and install all necessary piping connections required for flow devices.
      b. The Sheet Metal Contractor shall:
         1) Install all automatic dampers and provide necessary blank-off plates or transitions required to install dampers that are smaller than duct size.

2) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
3) Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation and fix and seal permanently in place only after stratification problems have been eliminated.
4) Provide access doors or other approved means of access through ducts for service to control equipment.
5) Furnish and install all smoke/fire dampers with electric actuators to meet UL listing.

c. The Electrical Contractor shall:
1) Furnish and install line voltage power where shown on the Electrical drawings is furnished and wired by Division 16.
2) Furnish and install 120 volt, 20 amp breaker for all ATC Panels. Refer to electrical power plan and mechanical drawings for location of ATC Panels.
3) Air Handling Unit duct smoke detectors shall be furnished, installed and wired by Division 16000, Electrical Contractor. Fan shutdown from the building Fire Alarm Panel by Division 16.
4) Provide the interlock control and wiring or the smoke/fire dampers furnished by the sheetmetal contractor.

B. Performance:
1. Control system shall be an extension of the existing Johnson Controls Metasys electronic Direct Digital Control System with remote monitoring and control at the campus Operator Workstations.
2. Qualified Contractors: Johnson Controls Inc., Branch Office. Contact Joe Morin @ 801-974-4542.

C. Submittals:
1. The following shall be submitted for approval:
a. Data sheets for all control systems and components.
b. Valve, damper, showing sizes, configuration capacity and location of all equipment.
c. Control system drawings containing pertinent data to provide a functional operating system, including a sequence of operation. Detailed shop drawings may be submitted in as-built form upon project completion.
d. Submit six (6) complete sets of documentation.

D. Wiring:
1. Electric wiring and wiring connections required for the installation of the temperature control system as herein specified, shall be provided by the Temperature Control Contractor unless specifically shown on the drawings or called for in the specifications to be by the Electrical Contractor. All wiring shall comply with the requirements of local and national electrical codes. All connections to vibrating equipment such as fans, pumps, condensing units, etc. shall be by flexible conduit. Plenum rated cable shall be permitted without EMT, in accessible ceiling spaces,

being used as a supply or return air duct. In all space with exposed ceiling structure, all wiring shall be installed in EMT raceway.

2. Wiring from the building fire alarm panel to smoke detectors shall be furnished and installed by Electrical Contractor.
3. Fan shutdown wiring from the Fire Panel shall be furnished and installed by the Electrical Contractor.
4. All cable shall be minimum 18 awg twisted shielded.
5. All cabling including communication cabling, binary inputs, binary outputs, analog inputs and analog outputs shall be wired using the same color cable for each type of I/O and/or communication type. (Example analog in = Yellow, analog output = tan, binary in = orange, binary out = purple, communication = blue.)
6. Install <u>conduit</u> in all walls from the room thermostat stubbed into the ceiling space. All wiring exposed and in mechanical rooms and walls shall be installed in minimum 2@ conduit.

E. Instruction and Adjustment:

1. Upon completion of the project, the Temperature Control Contractor shall adjust and validate all thermostats, controllers, valves, damper operators, relays, etc. provided under this section.
2. Instruction manuals shall be furnished covering the function and operation of the control system on the project for use by the owner's operating personnel. An instruction period shall last not less than **eight** (**<u>8) hours</u>** shall be provided to completely familiarize operating personnel with the temperature control system and direct digital controllers on the project. Four hours of this training period shall be spent exclusively on the DX series product.

F. Warranty:

1. Upon completion of the project as defined either by acceptance of the building by the Owner or by beneficial use of the equipment by the Owner, a warranty period of one year shall commence. The warranty shall consist of a commitment by the Automatic Temperature Control Contractor to provide at no cost to the Owner, parts and labor as required to repair or replace such parts of the temperature control system that prove inoperative due to defective materials or installation practices. This warranty expressly excludes routine service such as filter cartridge replacement, compressor lubrication or instrument calibration.

G. Project Completion Documentation**:**

1. Submit three (3) copies of operation and maintenance manuals including:
   a. Manufacturer's catalog data and specification of sensors, controllers, valves, actuators and other components.
   b. An operator's manual which will include detailed instruction for all operation of systems.
   c. A copy of the warranty letter.
   d. Control drawings with sequence of operation and bill of materials.
   e. A list of operating and maintenance procedures.
2. Submit three (3) copies of Instrument Check-Off sheets including:
   a. Installation verification of all I/O points signed and dated by the installer that performed the work.
   b. Software verification checkoff sheets verifying functional operation in accordance with the sequence of operation signed and dated by the technician that performed the work.

PART 2 - EQUIPMENT

2.1 OVERVIEW:

A. The Automatic Temperature Control of the mechanical equipment shall be through a local standalone DDC controller with electric damper and valve actuators where required. Individual room control functions shall be electronic. Any existing pneumatic control valves, control damper actuators and control dampers associated with the remodel portion of this project, shall be replaced with new components. All control devices shall be electronic and compatible with the existing Metasys BAS system.

2.2 APPLICATION SPECIFIC CONTROLLERS (GENERAL):

A. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

B. Each ASC shall have sufficient memory to support its own operating system and data bases including:
   1. Generic Input/Output Monitor and Control
   2. Control Processes
   3. Energy Management Applications
   4. Operator I/O (Portable Service Terminal)

C. Application Specific Controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include but not be limited to the following:
   1. Display temperatures
   2. Display status
   3. Display setpoints
   4. Display control parameters
   5. Override binary output control
   6. Override analog setpoints
   7. Modification of gain and offset constants
   8. Modified selected HVAC configuration programs and down load modifications.

D. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

2.3 CENTRAL OPERATOR WORKSTATIONS:

A. This contractor shall modify the existing operating software to monitor and control the mechanical hardware points for the Activity Center. The software programming point descriptors shall match the existing campus hardware descriptors. Prior to software programming, submit a point list of system operation to the maintenance staff for review and comments.

B. Upon substantial completion, this contractor shall perform a software back-up/save of the operating software. One back-up copy shall remain at the central

operator workstation location, the other copy will be given to the Maintenance Director.

2.4 CONTROL PANELS:

A. All controllers, relays, switches, etc., for equipment located within equipment rooms shall be mounted in enclosed control panels with hinged locking doors. All control devices for equipment located in exposed areas subject to outside weather conditions, shall be mounted inside waterproof enclosures.
B. All electrical devices within the panel shall be pre-wired to terminal strips with all inter-device wiring within the panel completed prior to installation of the system.
C. All I/O connections on the DDC controller shall be extended to a numbered, color coded and labeled terminal strip for ease of maintenance and expansion. Wiring to I/O devices shall be made from this terminal strip.
D. Furnish and install a fused transformer and provide a 120V outlet in each panel.
E. Local control panels or Direct Digital Controller shall not be mounted on the fan plenum duct walls. To avoid vibration, panels shall be mounted on a solid bearing wall or a pedestal shall be constructed by temperature control contractor.
F. All inputs and outputs from the DDC controller shall be pre-wired to terminal strips. I/O not being used in the controller shall also be wired to the terminal strip for future expansion.
G. All panel wiring shall conform with the wiring requirements of Section 15971-1.3, D.

2.5 TEMPERATURE SENSORS:

A. Space sensors shall be Johnson Controls model # TE-67-NP-0000
B. Duct mounted averaging sensors shall use a sensing element incorporated in a copper capillary with a minimum length of 20'/ The sensor shall be installed according to manufacturers recommendation and looped and fastened at a minimum of every 36".
C. Thermowells for all immersion sensors shall be stainless steel or brass as required for each application.

2.6 CONTROL DAMPERS:

A. Motorized control dampers, unless otherwise specified elsewhere, shall be low leakage type Johnson Controls D-1300 Performance Dampers. Damper blades shall be airfoil shaped, 16 gage galvanized steel double skin constructed. Blades are to be suitable for high velocity and high differential shutoff performance. Frame shall be constructed of minimum 16 gage galvanized steel hat channel with corner braces. Blade axles shall be 3/4" plated steel with stainless steel bearings. Provide replaceable EPDM or appropriate material blade seals and flexible stainless steel jam seals. The damper and seals shall provide a maximum leakage rate of 8 cfm/sf @ 1" W.C. pressure differential. The damper shall be rated to operate with differential pressures up to 14" WC. The damper linkage shall provide a linear flow or equal percentage characteristic as required.
B. Control dampers shall be parallel or opposed blade type as scheduled on drawings. Outdoor and return air mixing box dampers shall be parallel blade, arranged to direct airstreams towards each other. All other dampers may be parallel or opposed blade type.

2.7 DAMPER OPERATORS:

A. Damper Operators: Damper actuators shall be sized with enough torque to open the damper when the associated unit is operating. Where required install multiple dampers operators. Damper operators shall be electric with either proportional or incremental control.

2.8 CONTROL VALVES:

A. All automatic control valves shall be fully proportioning with modulating plugs for equal percentage on linear flow characteristics. The valves shall be sized by the control manufacturer and by provided with actuators of sufficient power for the duty intended. Valve body and actuator selection shall be sufficient to handle system pressure and shall close against the differential pressure liable to be encountered on the project.

B. General: Control Valves up to 4 inch shall be sized for a 3 to 5 psi drop valves shall be packless, modulating, pneumatically actuated. These valves shall have a true linear flow characteristics in a relationship to valve opening.

2.9 ELECTRIC THERMOSTATS:

A. Electric room thermostats shall be line voltage type with metal locking cover. Adjustment shall be concealed or exposed as indicated in the sequence of operation. Electrical rating shall be a minimum of 20 percent greater than the load being controlled. Provide insulating base where thermostat is mounted on exterior walls.

2.10 LOW LIMIT THERMOSTAT:

A. Provide manual reset low limit thermostats in the leaving air of each coil that is subject to freezing conditions and as specified elsewhere in these specifications. Thermostats shall have a 20 foot (minimum) element and shall respond to the coldest one foot section of that element. Provide sufficient thermostats to adequately protect the entire face area (a minimum of one for every 35 square feet of coil).

2.11 DUCT SMOKE DETECTORS:

A. Duct smoke detectors shall be furnished, installed and wired by Division 16. Duct detectors shall be wired to the Fire Alarm Panel by Division16.

B. Fan shutdown shall be wired to the local ATC panel by Division 16.

2.12 DIFFERENTIAL PRESSURE:

A. The differential pressure transmitter shall withstand up to 150% of the rated pressure, with an accuracy of +1% of full scale. The sensing element shall be either capsule, diaphragm, bellows, or solid state. The transmitter shall convert the sensing element output to a linear 4 to 20 ma dc output corresponding to the required pressure span. The transmitter shall include offset and span adjustments.

2.13 PROOF OF FLOW:

A. Proof of flow for all motors not controlled by variable speed drive shall be through current switches monitoring the motor load current.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Control systems shall be installed per manufacturer-s recommendations.
B. Control systems shall be installed in such a manner as to operate as required by Section 15940 Sequence of Operation.

END OF SECTION 15910

SECTION 15940 - SEQUENCE OF OPERATION

PART 1 - GENERAL
(Not Used)

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 NEW VAV AIR HANDLERS:

A. The supply fan VFD shall be started and stopped by the local ASC according to a pre-programmed schedule. When in the occupied mode, the fan shall run continuously.

B. A low limit freeze protection thermostat with element sensing the leaving air shall stop the fan and close the outside air dampers when temperatures below 35E are detected anywhere along the length of the sensing element.

C. Ionization type products of combustion detectors (smoke detectors) shall be furnished, installed and wired by Division 16 in the supply and return air.

D. The fire alarm panel will send a signal to the fan starter which shall stop the fan whenever the fire alarm system is in alarm. Wiring from the fire alarm panel to the duct smoke detectors and to the fan shutdown relay will be provided by the Division 16 Electrical Contractor.

E. A high limit static pressure switch with manual reset shall stop the supply fan whenever the static pressure at the fan system discharge exceeds 3.5 inches of w.g. (adjustable).

F. In the occupied mode, once the fan system is operating the outside air damper shall open to the minimum (adjustable) position set by test and balance contractor.

G. The local ASC shall average corresponding VAV space temperature sensors and reset the discharge air temperature by staging the DX cooling, hot gas bypass valve, hot water reheat valve and associated coil pump in sequence to maintain the discharge air temperature reset schedule:

Space Temp.	Discharge Temp.
74 E	55 E
68 E	65 E

H. A mixed air temperature sensor will override the outside air dampers to limit the mixed air from going below 50E.

I. A temperature sensor located in the outside air (North Exposure) shall return the outside air damper to the minimum position whenever the outside air temperature is above 78E. The outside air damper shall close whenever the fan is off, during power failure, and upon loss of control signal. When outside air temperature is less than building return air temperature, outside air damper shall modulate open to achieve lowest mixed air temperature possible.

J. The duct static pressure shall be controlled by monitoring a duct static pressure sensor located approximately two thirds of the way downstream of the supply fan. An output from the local ASC shall modulate the supply fan VFD to maintain 1inch w.g. (adjustable).

K. The relief air damper shall modulate to maintain space static pressure of 0.03" (adj.).

L. The outside air, and return air damper are furnished with the Air Handling Unit. The relief air dampers are furnished separately by the ATC contractor. The ATC Contractor will be responsible to furnish and install the electronic damper actuators.

M. The electrical Contractor for Division 16 shall furnish and install the Variable Frequency Drives and required power wiring. On fan startup, the local ASC shall enable the IAQ minimum outside air controller. The IAQ shall maintain minimum CFM setpoint as adjusted by the controller.

3.2 VAV BOXES W/ REHEAT COILS

A. A space temperature sensor shall, through the Application Specific Controller (ASC), modulate the VAV damper and reheat coil valve in sequence to maintain space temperature setpoint. The VAV Box minimum and maximum heating and cooling CFM shall be controlled by the ASC. When the heating system is not operating the VAV Box minimum CFM shall be reduced. If any space temperature cannot be maintained at the reduced minimum CFM, the fan system discharge air temperature setpoint shall be increased until all areas are at or above the heating setpoint. Each VAV box shall have a discharge air sensor for reference.

3.3 EXISTING BUILDING MAIN HEATING HOT WATER SYSTEM VARIABLE SPEED PUMPS

A. Adjust DC set pint as necessary to accommodate new addition. Coordinate with Test and Balance contractor.

END OF SECTION 15940

SECTION 15960 - AIR SYSTEM TEST AND BALANCE

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Testing, balancing and adjusting of the following systems:
      a. Supply and Return Air
      b. Exhaust Air
      c. Relief Air
   2. Test Report bound in Operating and Maintenance Manuals.
   3. Contractor shall make changes in pulleys, belts, motors and dampers or add dampers as required for correct balance as recommended by Air Balance & Testing Agency at no additional cost to Owner.

1.2 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.3 AGENCY:

A. Contractor shall procure services of an independent Air Balance & Testing Agency which specializes in balancing and testing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
B. Agency shall provide proof of having successfully completed at least five projects of similar size and scope and be a certified AABC, NEBB or TABB agency. Work by this Agency shall be done under direct supervision of a qualified registered professional heating and ventilating engineer employed by Agency. Agency shall maintain an office within 75 miles of project.
C. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
D. If requested, conduct tests in presence of Architect.
E. Agency shall be approved in writing by the Architect. Neither Architect=s, Engineer nor anyone performing other work on this Project under Division 15 shall be permitted to do this work.
F. Contractor shall award test and balance contract to the approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.
G. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of the Air Balancing Test Report.
H. Engineer will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire project.
I. Rebalancing shall be done in presence of Architect and subject to his approval.
J. Spot balance and rebalance shall be performed at no additional cost to Owner.
K. Approved Balancing Agencies
   1. Bonneville Test and Balance
   2. BTC Services

3. Certified Test and Balance
4. Danis Test and Balance
5. Intermountain Test and Balance
6. RS Analysis
7. Technical Specialties
8. Testing and Balancing Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin air balance and testing upon completion of the mechanical installation of air conditioning, ventilation, heating, exhaust systems, and controls including installation of all specialties and devices.

3.2 PROCEDURES:

A. Before any adjustments are made, the system is to be checked for items such as dirty filters, filter leakage, major duct sections, zones, etc.
B. Contractor shall place exhaust and ventilating systems and equipment into full operation and continue their operation during each working day of testing and balancing.
C. Air Balance & Testing Agency shall perform tests specified, compile test data, and submit four copies of complete test data to Contractor for forwarding to Engineer for evaluation and approval.
   1. Approved copies of report shall be bound in Operations & Maintenance Manuals. See Division 15010 General.
D. Systems shall be completely balanced and all reports submitted to Engineer 72 hours prior to test run and final inspection.
E. System performance shall be checked when outside weather is at or near design conditions, if practicable. Heating and/or cooling thermometers or sensors shall be placed in the areas served by each fan system. Temperature readings shall be taken at half hour intervals, and further adjustments or corrections made as required to obtain uniform temperatures. All occupied spaces shall be checked for drafts and noises caused by the make-up and exhaust systems, and any unsatisfactory conditions corrected.
F. Balancing shall be performed during normal project working hours when project construction foreman is present on the job site to provide access and see his mechanical sub contractor is available to operate system and make necessary corrections.

3.3 STANDARDS:

A. Balance shall be performed in complete accordance with the following standards as applicable to the agency certification:
   1. HVAC Systems Testing, Adjusting, and Balancing, SMACNA 1983.
   2. Testing, Balancing, and Adjusting of Environmental Systems, SMACNA 1974.
   3. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, NEBB 1983.
   4. AABC National Standards, Fourth Edition 1982.

5. Procedural Standard for Measuring Sound and Vibration, NEBB 1977.

B. Balancing Agency's National Certification shall warrant the system balance and performance. A copy of guarantee certificate shall be included in each test and balance report.

3.4 TESTING PROCEDURE:

A. Air Balance & Testing Agency shall perform following tests and balance system in accordance with following requirements:
B. Test and adjust blower rpm to design requirements.
C. Test and record motor full load amperes.
D. Make Pitot Tube tranverse of main supply and obtain design cfm.
E. Test and record system static pressures, suction, and discharge.
F. Test and adjust system for design cfm air.
G. Test and adjust system for design cfm outside air.
H. Test and record entering air temperatures (db heating and cooling).
I. Test and record entering air temperatures (wb cooling).
J. Test and record leaving air temperatures (db heating and cooling).
K. Test and record leaving air temperatures (wb cooling).
L. Adjust main supply and return air ducts to proper design cfm, + or - 5%.
M. Adjust zones to proper design cfm, supply and return, + or - 5%.
N. Test and adjust each diffuser and grille to design requirements. Individual air outlets, when one of three or more are serving one space, may have a tolerance of 10% from the average.
O. Identify each diffuser and grille as to location and area served.
P. Identify and list size, type, and Manufacturer of diffusers, grilles and testing equipment. Use Manufacturer's rating on equipment to make required calculations.
Q. In readings and tests of diffusers and grilles include required cfm and fpm velocity & test cfm and fpm after adjustments.
R. In cooperation with Section 15 900, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
S. Adjust diffusers and grilles to minimize drafts.

3.5 EXHAUST AIR SYSTEMS:

A. Systems are to be adjusted to same tolerance as supply systems. Each space is to be checked to see that it is positive, neutral or negative as indicated by quantities of supply and exhaust air shown on contract documents. Any discrepancies shall be investigated and corrected, and the proper pressure relationship established.
B. Building pressure shall be checked at outside doors, relief air damper adjusted as required to leave building neutral or under slight positive pressure.

3.6 REPORT

A. Report shall include:
   1. Record test data on AABC standard forms or facsimile thereof.
   2. A set of black and white or blue line prints with all air openings marked to correspond with data sheets and with temperature clearly marked.

3. Show on final report the percent of design CFM to the actual CFM of each diffuser represents.
4. The certified report shall include for each air handling system the data listed below:
    a. Equipment
        1) Installation data
            a) Manufacturer and model
            b) Size
            c) Arrangement, discharge, and class
            d) Motor hp, voltage, phase, cycles, and full load amps
            e) Location and local identification data
        2) Design data
            a) Data listed in schedules on drawings and specifications.
        3) Fan recorded (test) data
            a) cfm
            b) Static Pressure
            c) rpm
            d) Motor operating amps
            e) Motor operating bhp
    b. Duct systems
        1) Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust.
            a) Duct size(s)
            b) Number of Pitot tube (pressure) measurements.
            c) Sum of velocity measurements (Note: Do not add pressure measurements)
            d) Average velocity
            e) Recorded (test) cfm
            f) Design cfm
        2) Individual air terminals
            a) VAV box number and maximum and minimum settings.
            b) Terminal identification (supply or exhaust, location and number designation)
            c) Type size, manufacturer and catalog identification
            d) Applicable factor for application, velocity, area, etc., and designated area
            e) Design and recorded velocities - fpm
            f) Design and recorded quantities - cfm
            g) % of design recorded quantity- cfm represents

END OF SECTION 15960

SECTION 15970 - WATER SYSTEM ADJUSTING & BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide hot water system testing & balancing.

1.2 SUBMITTALS

A. Quality Assurance - Agency will submit complete test data to Architect for evaluation and approval including neatly typed listing of items required by Contract Documents at least 72 hours before final test run and final inspection.

B. Closeout Submittals - Agency will submit approved copies of water test and balance report for inclusion in Operations & Maintenance Manual.

1.3 QUALITY ASSURANCE

A. Qualifications - Work by Agency will be performed under direct supervision of qualified Heating and Ventilating Engineer employed by Agency.

1.4 SEQUENCING

A. Test and balance subcontract will be awarded to Agency upon contractors receipt of Notice To Proceed to allow Agency to schedule this work in cooperation with work of other Sections involved and to comply with completion date.

B. Schedule testing & balancing to begin upon completion of cooling and heating systems including installation of all specialties and devices. Begin work of this Section after heating, ventilating, and cooling systems and equipment are in full operation and continue their operation during each working day of testing and balancing. Agency shall be same as is performing work under section 15960.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Site Tests

1. Instruments used by Agency will be accurately calibrated and maintained in good working order.
2. Balance & Testing Agency will provide technicians with following instruments for field use
   a. One set of pressure gauges and fittings
   b. Dry bulb thermometer
   c. Wet bulb thermometer
   d. Thermocouple unit and thermocouples
   e. Set of balancing cock adjustment wrenches
   f. Portable field flowmeter
3. If requested, conduct tests in presence of Architect.

4. Preparation of System - Phase I
   a. Open valves to full position including coil stop valves, close bypass valves, and return line balancing cocks.
   b. Remove and clean strainers.
   c. Examine water in system to determine if it has been treated and is clean.
   d. Check pump rotation.
   e. Check air vents at high points of water systems to make sure they are installed properly and are operating freely. Make certain air is removed from circulating system.
   f. Set temperature controls so coils are calling for full heating.
   g. Check operation of automatic valves.
   h. Perform air balance before beginning water balance.
5. Performance of Testing & Balancing - Phase II
   a. Set new pumps to proper gpm delivery.
   b. Check water temperature at inlet side of coils. Note rise or drop of temperatures from source.
   c. Balance each water coil.
   d. Upon completion of flow readings and coil adjustments, mark settings and record data.
6. Performance of Testing & Balancing - Phase III
   a. After making adjustments to coils, recheck settings at pumps. Readjust if required.
   b. Install pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full heating.
   c. Check and record the following items at each heating element -
      1) Inlet water and air temperatures
      2) Leaving water and air temperatures
      3) Pressure drop of each coil
      4) Pressure drop across bypass valve
      5) Pump operating suction and discharge pressures and final TDH
      6) Mechanical specifications of pumps
      7) Rated and actual running amperage of pump motor

END OF SECTION 15970

SECTION 15990 - FINAL TEST RUN

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.2 QUALITY CONTROL:

A. Final inspection will not be scheduled till all tests are done and O & M's submitted.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURE:

A. Contractor shall make a test run with all equipment operating continuously at design conditions for a period of 2 days or longer as necessary to demonstrate the system fulfills all requirements and operates satisfactorily. Contractor shall notify Engineer in writing when he is ready to begin test. Contractor shall provide manpower to run test and operate equipment as may be required during test run. Contractor shall be responsible for all equipment during this test. The test shall run 24 hours per day with temperature control system resetting temperatures for night-day and weekends as specified.

B. Neither the final inspection nor the final payment shall be made to the Contractor until the heating, ventilation and cooling systems operational tests have been completed, balancing reports submitted, and Owner and Engineer satisfied.

C. Operating tests of the heating system shall be made during the winter season of the first year of operation at times directed, for the proper setting and adjusting of the controls under peak load conditions.

D. Air Conditioning Systems: Operating test of the completed air conditioning systems shall be made during the summer season of the first year of operation at times directed. Each system shall be operated for periods of 6 hours minimum; test for air flow and temperature, to demonstrate compliance with required plans and specifications.

E. Recalibrate fresh air, return air and mixed air controls in areas effected by the renovation.

F. Furnish copies of test data, computation, results, as directed.

G. Applicable requirements under air conditioning tests shall govern similar work in heating, unless otherwise specified.

H. Temperature Controls: Manufacturer of automatic controls shall regulate and adjust thermostats, and other controlling devices; he shall place control systems in satisfactory operating conditions; he shall also instruct assigned operating personnel in operation and maintenance of these controls. Furnish diagrammatic layouts of automatic control systems, and two sets of printed instructions for Owners operation and maintenance charts.

I. When final adjustments have been made, temperature readings shall be taken at a minimum of half hour intervals for a three hour period minimum. All damper positions shall be marked and access covers replaced.

END OF SECTION 15990

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical work is indicated on drawings and/or specified in Division 16 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	ITEM	SECTION
1.	Electrical General Provisions	16001
2.	Electrical Connections for Equipment	16070
3.	Demolition	16080
4.	Conduit Raceways	16110
5.	Conductors and Cables	16120
6.	Medium Voltage Cable Splices & Terminations	16122
7.	Electrical Boxes and Fittings	16135
8.	Supporting Devices	16136
9.	Wiring Devices	16140
10.	Motor Starters	16155
11.	Variable Frequency Drives	16156
12.	Panelboards	16160
13.	Motor and Circuit Disconnects	16170
14.	Overcurrent Protective Devices	16180
15.	Transformers	16181
16.	Grounding	16452
17.	Interior and Exterior Building Lighting	16510
18.	Fire Alarm and Detection Systems	16721
19.	Telephone Systems (Raceways)	16740

B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.

C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

A. The following terms used in Division 16 documents are defined as follows:

1. "Provide": Means furnish, install and connect, unless otherwise indicated.
2. "Furnish": Means purchase and deliver to project site.

3. "Install": Means to physically install the items in-place.
4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 16 sections.

C. Earthwork:

1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes, lighting pole foundations, etc. See Division 2, Sitework, and other portions of Division 16, for material and installation requirements.

D. Concrete Work:

1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for under ground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc.See Division 3, Concrete for material and installation requirements.

E. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.

F. Miscellaneous Lumber and Framing Work:

1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.

G. Moisture Protection:

1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

H. Access panels and doors:

1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

I. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:

1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
3. Motorized dampers.
4. Fire and smoke dampers
5. Irrigation controllers.
6. Temperature control panels.
7. Water coolers.

1.6 ITEMS FURNISHED UNDER ANOTHER DIVISION, BUT INSTALLED AND CONNECTED UNDER THIS DIVISION:

A. Items furnished under other Divisions, but turned over to Division 16 for installation and final connection include, but are not necessarily limited to, the following.

1. Wall mounted control stations for motorized roll-up doors/grills.
2. Wall mounted control stations for motorized projection screens.

1.7 WORK NOT INCLUDED IN THIS DIVISION:

A. Items of work provided under another contract include, but are not necessarily limited to, the following:

1. Telephone cables and electronic equipment.
2. Data system cables, fittings, coverplates and electronic equipment.
3. Control wires for irrigation control valves.
4. Energy management/temperature control system; both line and low voltage including conductors and conduit.
5. Television monitors and projection equipment.
6. Security system equipment, cables, fittings, and coverplates.
7. CCTV and MATV cabling and electronic equipment.

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.9 QUALITY ASSURANCE:

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. National Electric Code (NEC).
2. International Building Code (IBC).
3. International Fire Code (IFC).
4. International Mechanical Code (IMC).

C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.

1.	UL	Underwriters' Laboratories
2.	ASTM	American Society for Testing Materials
3.	CBN	Certified Ballast Manufacturers
4.	IPCEA	Insulated Power Cable Engineers Association
5.	NEMA	National Electrical Manufacturer's Association
6.	ANSI	American National Standards Institute
7.	ETL	Electrical Testing Laboratories

D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents which may be in excess of the aforementioned requirements, and not contrary to same.

F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.10 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of $200.00 for the third review and any additional reviews required.

2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.

3. Certifications shall be written or in the form of rubber stamp impressions as follows:

4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed_____.

Position_____ Date

5. Observe the following rules when submitting the Shop Drawings and Brochures.

a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

b. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be

prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

c. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.11 OPERATION AND MAINTENANCE MANUALS:

A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.

B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones B3-367-44). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.

C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).

D. Include the following information where applicable.

1. Identifying name and mark number.
2. Certified outline Drawings and Shop Drawings.
3. Parts lists.
4. Performance curves and data.
5. Wiring diagrams.
6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
7. Manufacturer's recommended operating and maintenance instructions.
8. Vendor's name and address for each item.

E. The engineer shall review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of $200.00 for each review afterwards.

1.12 RECORD DRAWINGS:

A. Maintain, on a daily basis, a complete set of “Record Drawings”, reflecting an accurate record of work in accordance with the following:

1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)

2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).

3. Show all changes, deviations, addendum items, change orders, job instructions, etc., which change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.

B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The “Record Drawings” for daily recording shall consist of a set of blue line prints of the Contract Drawings.

C. Upon completion of the work, purchase a complete set of reproducible mylar sepia drawings with the Architect/Engineer’s seal and firm name removed or blacked out. Transfer all “Record” information from the blue line prints to the sepias. The sepias shall be reviewed by the Architect/Engineer and the resulting comments shall be incorporated into the final record sepias by the contractor.

D. Certify the “Record Drawings” for correctness by placing and signing the following certifications of the first sheet of the sepia:

1. "CERTIFIED CORRECT (3/8" high letters)

<u>(Name of General Contractor)</u>

By _____ Date

<u>(Name of Electrical Contractor)</u>

By_____ Date

1.13 GUARANTEE:

A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials which develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.

C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.

E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.

C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

D. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.

E. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

A. General: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner which protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more stringent), unless noted otherwise on drawings.

B. Protect persons from injury at excavations, by barricades, warnings and illumination.

C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

D. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.

E. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.

F. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

G. Retain excavated material which complies with requirements for backfill material. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.

B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.

C. For top 6" of excavation - Top soil.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
2. Paved Areas, Other than Roadways (90 percent for cohesive soils, 95 percent for cohesionless soils).

E. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 CONCRETE BASES:

A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Not withstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 380-8.

B. Concrete bases shall be provided under Division-16. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.

C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Utah Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

3.8 ROOF PENETRATIONS:

A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

3.9 FIRE PENETRATION SEALS:

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.10 PROJECT FINALIZATION AND START-UP:

A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.

B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.

C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or

operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

D. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.

E. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

1. SYSTEM	FACTORY REPRESENTATIVE
(List systems included)	(List name and address of Factory Representative).
_____	_____
Owner's Representative	Contractor

F. Send copy of acceptance to Architect/Engineer.

3.11 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 16001

SECTION TITLE - 16070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.

B. Refer to Division-15 sections for motor starters and controls furnished integrally with equipment; not work of this section.

C. Refer to Division-15 section for control system wiring; not work of this section.

D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 – PRODUCTS

2.1 GENERAL:

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 16110, Conduit Raceways; Section 16140 Wiring Devices: and Section 16120 Wire and Cable for additional requirements. Provide final connections for equipment consistent with the following:

B. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.

C. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).

D. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Refer to basic materials and methods Section 16120, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 16070

SECTION 16080 – DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2A Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.

B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.

C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.

D. Refer to sections of other Divisions for applicable requirements affecting demolition work.

E. Refer to Section 16001 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE:

1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

2.2 PATCHING AND REPAIR

A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.

B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc.

C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

2.3 EXISTING EQUIPMENT

A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.

B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.

C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.

D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.

E. When installing equipment in the existing building, it shall be concealed.

F. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.

G. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.

H. Existing raceways shall be used where possible, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated.

I. The existing light fixtures which are not used in the remodeled area shall be carefully removed, and turned over to the owner or properly disposed of per the owner’s direction. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, relamped and installed as indicated.

J. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

K. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 16080

SECTION 16110 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit
3. Intermediate Metal Conduit
4. Liquid-tight Flexible Metal Conduit
5. Rigid Metal Conduit
6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

C. SUBMITTALS: Not required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. GENERAL:

1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.

C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.

D. PVC EXTERNALLY COATED RIGID STEEL CONDUIT: ANSI C80.1 and NEMA Std. Pub. No. RN 1.

E. ALUMINUM CONDUIT: Not acceptable.

F. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

G. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

H. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

I. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

J. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.

K. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

L. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

M. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

A. GENERAL:

1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".

B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:

1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.

C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:

D. ANSI/NEMA TC 9, match to duct type and material.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 SEALING BUSHINGS:

A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.5 CABLE SUPPORTS:

A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

1. SERVICE ENTRANCE CONDUCTORS, AND CONDUCTORS OVER 600 VOLTS:
   a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct, individually encased in concrete. See duct banks.

2. BRANCH CIRCUITS, FEEDERS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
   a. Install in electric metallic tubing (EMT); except in poured walls, with one side in contact with grade, below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in GRC or IMC. In suspended slabs, install in EMT. Encase non-metallic duct 1-1/4" and larger in concrete. See duct banks.

B. Provide 300 feet of 3/4" conduit with 3 #12 conductors and 300 feet of 3/4" conduit with 3 #10 conductors. Install only as directed by engineer.

C. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

D. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel

finish coat to match adjacent raceway surface.

E. Comply with NEC for requirements for installation of pull boxes in long runs.

F. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

G. Replace all crushed, wrinkled or deformed raceway before installing conductors.

H. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device which supplies uniform heat over the entire area without scorching the conduit.

I. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.

J. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.

K. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

L. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.

M. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

N. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.

O. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

P. Raceway installation below slab-on-grade, or below grade:

1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.

2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.

3. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and

do not exceed an overall width of 16", install a single line marker.

4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

Q. Raceway installation in suspended slabs:

1. Install conduit as close to the middle of concrete slab as practicable without disturbing reinforcement. Do not install conduits of diameter greater than 1/3 of the slab thickness. Space conduits not less than 3 diameters on center (except at stub up locations). Provide OZ expansion fittings at all expansion joints. All raceways shall be installed with concrete tight fittings. Include copper ground conductor in all raceways installed in suspended slabs.
2. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.

3. Engage at least five full threads on all fittings. Provide inspection fittings with explosion proof drains to prevent water accumulation in conduit runs. Install seal-offs for arcing or high temperature equipment, at housing with splices or taps and where conduits enter or leave the hazardous area. Provide seal-offs of the appropriate type for vertical or horizontal installation. Ground all metallic parts.

R. DUCTBANKS:

1. Provide ductbank construction as indicated using 3000 psi at 28 day strength concrete, with red marker dye. Use Type II low alkali per ASTM C150. Use ASTM C-33 aggregate gradation with maximum size of 3/4". Use W/C ratio of 0.50. Install #4 reinforcing bar per ASTM 615 grade 50 in each corner of ductbank. Provide minimum 4" concrete cover on all sides of exterior conduits. Provide polypropylene pull rope in all spare duct.

END OF SECTION 16110

SECTION 16120 - CONDUCTORS AND CABLES (600V AND BELOW)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors (600V)
2. Non-metallic sheathed cable

C. Applications for conductors and cables required for project include:

1. Power Distribution
2. Feeders
3. Branch Circuits

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.4 SUBMITTALS:

A. FIELD TEST DATA:

1. Submit megohmmeter test data for circuits under 600 volts.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Service Entrance Conductors - Copper conductor; see drawings for insulation

type.

2. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger - Copper conductor; THHN/THWN insulation.

3. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.

B. Provide connectors and terminations for aluminum-alloy conductors of compression type only, listed under UL 486-B, and marked "AL 7CU" for 75o rated circuits, and "AL9CU" for 90o rated circuits.

C. Provide color and coding of conductors as follows:

120/208V	277/480V
A-Phase - Black	A-Phase - Brown
B-Phase - Red	B-Phase - Purple
C-Phase - Blue	C-Phase - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

D. Provide colors for switch legs, travelers and other wiring for branch circuits different than listed above.

E. Provide #10 AWG neutral conductor for all three and four wire fluorescent circuit home runs.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.

E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.

F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.

G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.

H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and which is listed by UL.

I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.

J. Support all cables in pullholes, concrete trenches, and similar locations by cable racks and secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator. In manholes, pullholes, concrete trenches, and similar locations, wrap strips of fire-proofing tape (approx. 1/16 inch thick by 3 inches wide) tightly around each cable spirally in half-lapped wrapping or in two butt-joined wrappings with the second wrapping covering the joints in the first. Apply tape with the coated side toward the cable, and extend tape one inch into the ducts. To prevent unraveling, random wrap the fireproofing tape the entire length of the fireproofing with pressure sensitive glass cloth tape. Provide fireproofing tape of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick weighing not less than 2.5 pounds per square yard. Provide tape which is noncorrosive to cable sheath, self-extinguishing, and which will not support combustion. Construct tape of materials which do not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.

K. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Submit record in triplicate of megohmmeter readings to Architect/Engineer.

B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

C. IDENTIFICATION OF FEEDERS: Each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, shall have a marker affixed, upon which is stamped or embossed the feeder designation; i.e. "MCCI", "PANEL L", "CHILLER", "NO. 1", etc. Identification letters shall be 1/8 inch minimum size. Markers shall be rigid, non-corrosive material, attached to the feeder cables with feeder identification. Nylon straps shall be used to tie the markers.

END OF SECTION 16120

SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to electrical wiring boxes and fittings specified herein. See Section 16110, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Floor Boxes
5. Conduit Bodies
6. Bushings
7. Locknuts
8. Knockout Closures
9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.4 SUBMITTALS: None required

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x1-1/2". Provide minimum 2-1/8" depth for boxes with three or more conduit entries.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and

metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. FLOOR BOXES:

1. Provide leveling and fully adjustable floor service receptacle outlets and fittings of types and ratings indicated; and with finish as selected by Architect. Equip with wiring devices as specified in section 16140. Provide boxes compatible with floor system; provide (cast iron) or (steel) boxes for slab-on-grade construction. Equip with tile and/or carpet flanges to accommodate floor finish material. Provide equipment as follows:

F. MANUFACTURER:

1. Subject to compliance with requirements, provide floor boxes of one of the following:

a. Bell Electric/Square D Co.
b. Crouse-Hinds Co.
c. Harvey Hubbell, Inc.
d. Steel City/Midland-Ross Corp.

G. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

H. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's

"Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

3. Provide coverplates for all boxes. See Section 16140, Wiring Devices.

4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

5. Provide knockout closures to cap unused knockout holes where blanks have been removed.

6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.

7. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.

8. Provide electrical connections for installed boxes.

END OF SECTION 16135

SECTION 16136 - SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-16 sections. See Section 16110, Raceways, for additional requirements.

B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from

building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. RACEWAYS:

1. Support raceways which are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90 degree bend. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	3/4" TO 1-1/4" 0	1-1/2" & LARGER 0
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

E. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers, oil switches, battery packs and racks, and similar equipment furnished under Section 16.

F. WIREWAYS, BUS DUCTS AND CABLE TRAYS:

1. Provide vertical and lateral support systems for all wireways, busway, and cable trays which are supported from overhead structure. See drawings for support and attachment details.

END OF SECTION 16136

SECTION 16140 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles
2. Switches
3. Dimmer controls
4. Cord caps
5. Cord connectors

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices which have been UL listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

A. FABRICATED WIRING DEVICES:

B. GENERAL:

1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.

2. Provide wiring devices (of proper voltage rating) as follows:

MFGR.	RECEPTACLE	SWITCHES 1-POLE	3-WAY	4-WAY	W-PILOT
Hubbell	HBL5352	HBL 1221	HBL 1223	HBL1224	HBL1221-PL
Bryant	5352	1221	1223	1224	1221-PL
Pass Seymour	5352	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	5362	1221	1223	1224	
Cooper	5352	1221	1273	1224	1221-PL

3. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.

C. TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) RECEPTACLES:

1. Provide TVSS receptacles having 4 series parallel 130V MOV's capable of a minimum of 140 joules suppression. Provide units with visual (and audible) surge status indicators to monitor condition of surge circuit; visual indicator to be "on" when power present and suppression circuit is fully functional. (Audible indicator shall sound a "beep" alarm approximately every 30 seconds if suppression circuit has been damaged.) Provide NEMA 5-20R, 20 amp, 125V receptacle of one of the following manufacturers:

	MANUFACTURER	
SPECIFICATION GRADE	HUBBELL	PASS SEYMOUR
Duplex Recept-Visual only	5350	5352 XXXSP
Duplex Recept-Visual/Audible	5352	5362 XXXSP
Single Recept-Visual only	5351	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG5352S	IG5362 XXXSP
Single Recept-Isol Gnd, Visual only	IG5351S	N/A
HOSPITAL GRADE		
Duplex Recept-Visual/Audible	8300HS	8300 XXXSP
Single Recept-Visual only	8310HS	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG8300HS	IG8300 XXXSP
Single Recept-Isol Gnd, Visual only	IG8310HS	N/A

2. Color of devices selected by Architect. Provide red devices on all emergency circuits.

D. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade where required elsewhere by specification or drawings. Provide units of one of the following:

a. P&S/Sierra
b. Hubbell
c. Leviton
d. Square D

E. CORD CAPS AND CONNECTORS:

1. Provide 3, 4 and 5-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment, and as indicated otherwise on drawings.

2. Provide products of one of the following:

a. Cooper
b. General Electric
c. Hubbell
d. Leviton
e. P&S

F. INCANDESCENT LAMP DIMMERS:

1. Provide branch lighting solid-state AC dimmer controls for incandescent fixtures; wattage and voltage as indicated, 60 hertz, with continuously adjustable slider control. Color as selected by Architect. Provide devices manufactured by one of the following:

a. Lutron (Nova Series)
b. Hubbell (AS Series)

G. FLUORESCENT LAMP DIMMERS:

1. Provide single-pole, semi-conductor modular type AC dimmers for fluorescent fixtures; 60 hertz, with wattage and voltage as indicated, continuously adjustable slider control, and with electromagnetic filters to reduce noise and interference to minimum. Construct with continuously adjustable trim potentiometer for adjustment of low end dimming. Color as selected by Architect. Provide devices manufactured by one of the following:

a. Lutron (Nova Series)

H. WIRING DEVICE ACCESSORIES:

1. WALL PLATES:

a. Provide coverplates for wiring devices; plate color to match wiring devices to which attached. Provide nylon or Lexan coverplates in all finished areas. Provide galvanized steel plates in unfinished areas. Provide blank coverplates for all empty outlet boxes. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics. Example "208V, 30A".

I. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 406-8 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device

covers which provide complete protection with the cord and cap inserted into the wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

a. Intermatic WP1020 or WP1030
b. P&S WIUC10C or WIUC20c

PART 3 – EXECUTION

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.

C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit to which the device is connected. Example: "CKT A-1".

D. Install blank plates on all boxes without devices.

E. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.

F. Install GFI receptacles for all receptacles installed in restrooms, outdoors or within six feet of any sink.

G. Where wall box dimmers are specified, provide a separate neutral for each phase of the branch circuits on which dimmers are installed.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. At time of substantial completion, replace those items which have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 16140

SECTION 16155 - MOTOR STARTERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of Division-16 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starters in this section include the following:

1. AC Fraction Horsepower Manual Starters
2. AC Line Voltage Manual Starters
3. AC Non-Reversing Magnetic Starters
4. AC Combination Non-Reversing Magnetic Starters

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on motor starters.

B. SHOP DRAWINGS: Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.

C. MOTOR VOLTAGE/CURRENT REPORT: After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.

PART 2 - PRODUCTS

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Eaton Corp., Cutler Hammer Products
2. General Electric Co.
3. Siemens Energy and Automation
4. Square D Co.

B. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 5 units of each, for both power and control circuit fuses.

2.2 MOTOR STARTERS:

A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information and as required for complete installations.

B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.

C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.

D. AC LINE VOLTAGE MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide line voltage manual starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt AC max; equip with pushbutton operator, low voltage protection feature, and green pilot light. Provide starters with trip free mechanism such that contacts will open under load and remain open until thermal element has cooled, and unit is reset. Mount surface units in NEMA 1 enclosure, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Provide overlapping trim for flush mounted units.

E. AC NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8536): Provide line voltage magnetic starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt max, with thermal overload protection in all phases and inherent under voltage release. Equip units with holding contact, 2 normally open, and 2 normally closed auxiliary contacts, unless noted otherwise. Provide fused control transformer in each starter and 120V control coil. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide NEMA 1 enclosure unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Equip all spare starters complete with items as specified herein.

F. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8539): Provide line voltage combination starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volts max with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with motor circuit protector. Provide motor circuit protector, instantaneous trip circuit breaker as indicated and adjust to comply with manufacturer's recommendations. Provide combination starters for individual mounting, or for group mounting in motor control center as indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise. Provide NEMA 1 enclosures unless otherwise indicated.

G. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8538): Provide line voltage combination starters, of types, ratings, and electrical characteristics; 2 or 3 pole, 600 volt maximum with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with fusible disconnect

switch. Provide quick-make, quick-break, disconnect for NEMA sizes 1, 2, 3, and 4; and visible blade, automatic circuit interrupters with push-to-trip feature and separate fuse clips for larger NEMA sizes. Fuse all starters with dual-element (time-delay) fuses equal to Bussman FRN/FRS-R. Equip disconnect switch with Class R rejection fuse kits. Provide combination starters for individual mounting, or for group mounting in motor control centers as indicated. Provide NEMA 1 enclosures unless otherwise indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

C. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each starter cabinet. Provide red plastic laminate label for starters supplied by emergency power. Include mechanical equipment designation, horsepower and voltage.

3.2 ADJUST AND CLEAN:

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 16155

SECTION 16156 - VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of variable frequency drive (VFD) work is indicated by drawings, schedules and specified herein. Work includes complete installation, electrical connections, testing, and commissioning.

B. Verify compatibility of VFD with motors supplied under Division 15. Review Division 15 specifications, plans, schedules, etc., to issue compatibility.

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and IEEE (including Harmonic Standard IEEE-519) Standards as applicable to wiring methods, construction and installation of variable frequency drives. Comply with applicable requirements of UL 508, "Power Conversion Equipment". Provide complete packaged units which have been UL-listed and labeled by Underwriters Laboratory or ETL Testing Laboratories, Inc. Note: The entire unit shall carry the label, not just components.

B. Provide VFD installation, line side voltage regulation, harmonic mitigation, and associated equipment coordination and interface by a factory trained and certified VFD contractor/supplier.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on variable frequency drives.

B. SHOP DRAWINGS: Submit dimensioned drawings of variable frequency drives including, but not necessarily limited to, the following:

1. Complete data sheet.
2. Set of outline drawings giving complete mounting information, conduit entry and exit dimensions, over all unit dimensions, weights, physical characteristics, etc.
3. Set of complete electrical drawings for power and control wiring.
4. Manufacture's literature giving detailed information of equipment being supplied including parts numbers, model numbers and ratings.

C. HARMONIC DISTORTION REPORT: After installation is complete, submit harmonic voltage and current distortion report as specified herein.

D. OPERATIONS MANUALS: After installation is complete, submit O&M manuals, to include harmonic voltage and current distortion report.

PART 2 – PRODUCTS

A. GENERAL: Subject to compliance with requirements, provide products manufactured by <u>and</u> supplied by the following vendor (NO EQUALS):

VENDOR	VFD MANUFACTURER
1. Energy Management Corporation	Mitsubishi

B. VENDOR REQUIREMENTS: Vendors requesting approval by addendum must meet the following minimum requirements.

2.2

1. Must be actively engaged in manufacturing and supplying pulse width modulated variable frequency drives and built up systems, and must have a minimum of five years of experience in each supply or manufacture, as applicable.
2. Must maintain full time service personal on call 24 hours/day as well as authorized parts and service facilities within 250 miles of the project with demonstrated record of service for at least the last three years.
3. Must have UL 508C or ETL certification if project requires "built-up" assemblies which are not "factory-standard" products.
4. Must be an ISO-9001 certified facility; manufacturing all products to ISO-9001 quality standards.

2.3 GENERAL:

A. Except as otherwise indicated, provide pulse width modulated variable frequency A.C. drives and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information and as required for a complete installation.

B. Integrate all components into a single, pre-integrated, stand-alone package produced by a single manufacturer/vendor.

2.4 APPLICATION:

A. Provide drive units which are applicable to the driven load characteristics. For centrifugal fan and pump applications, provide variable torque rated VFD's capable of providing 115% rated current for one minute. For conveyor, positive displacement pump, and compressor applications, provide constant torque rated VFD's capable of providing 150% of rated current for one minute. In addition, provide drives which meet the following operating conditions:

1. Operable on facility power, with voltage and phase indicated on the drawings, and without the need for isolation or step up/down transformers unless indicated.
2. Capable of performing at an altitude of 4500 feet above sea level and have an operating temperature range 0□ to 40□C (32□ to 104□F) with a relative humidity of 0 to 90% (non-condensing). If mounted outdoors or in unconditioned spaces, provide environmental control necessary to operate in climate of -20□C to 50□C (-4□ to 122□F), 0 to 100% R.H.

2.5 VARIABLE FREQUENCY DRIVE SYSTEM:

A. The variable frequency AC drive shall convert 3 phase, 60 Hertz input power to an adjustable AC frequency and voltage for controlling the speed of AC squirrel cage motors. The rectifier section (converter) shall employ a diode or fully gated bridge to develop a constant DC bus voltage. Variable voltage rectifiers utilizing partially gated SCR's are unacceptable. The DC bus shall utilize filter capacitors and DC link inductors to minimize generated harmonics. The PWM invertor control scheme shall produce an output wave form which closely approximates actual sine wave current. The output voltage shall vary proportionally with the output frequency to maintain a constant volts/hertz value up to 60 Hz. The output voltage will remain constant above 60 Hz. The

continuous current rating shall be equal to or greater than the full load amperes required by the application. Provide units capable of starting and continuously driving the specified maximum motor load as identified on drawings and schedules.

B. Provide system capable of operating without any system trip or damage based on the nominal power specifications and requirements indicated and subject to the following fluctuation:

1. Plus or minus 10% voltage fluctuation.
2. Plus or minus 3% frequency variation (5% if served by back-up generator)
3. Distorted voltage waveform with up to 10% total voltage harmonic distortion.
4. Provide system with voltage sag ride-through coordination under normal operating (average load) conditions to prevent nuisance trips with the following utility interruptions (based on preliminary IEEE working group P1346 data):

   a. 0% voltage for 1 cycle.
   b. 60% voltage for 10 cycles.
   c. 87% voltage continuous.

C. Provide voltage regulation on the line side of the VFD to prevent nuisance trips when the incoming voltage is between 505 volts and 528 volts on a 480 volt system.

D. The drive shall have sufficient capacity to provide speed control of the motor throughout the operating range as specified herein.

2.6 EFFICIENCY AND POWER FACTOR:

A. Provide solid state converter and invertor power switching components and controls to achieve a minimum 95% efficiency at full load and speed.

B. The displacement power factor (as measured at the input to the VFD system) shall be 95% or better across the operational speed range.

C. Provide passive filters as required to bring displacement power factor up to 95% or greater.

2.7 PROTECTION:

A. Provide short circuit protection by means of an externally operated, door interlocked circuit breaker or motor circuit protector (MCP) rated at 65,000 AIC minimum. Provide VFD;s with fast acting semi-conductor fuses to protect against input short circuits. The door interlocked handle must be capable of being locked off to meet NEC requirements.

B. Provide VFD operated motor overload protection by means of programmable, speed sensitive, electronic overload circuits with instantaneous trip, inverse time trip and current limit functions. These shall be adjustable and optimized for the application. Comply with NEC requirements and UL 991. In the by-pass mode provide motor overload relay set to protect the motor and capable of starting across the line.

C. Provide transient voltage surge suppression with maximum UL 1449 suppression rating of 1000 amps, line-to-ground on 480 volt systems, and 500 amps, line-to-ground on 208 volt systems.

D. In addition to the protection above, provide over- and under-voltage protection, over-temperature protection, ground fault protection, and control or microprocessor fault protection. These protective circuits shall cause an orderly shutdown of the VFD, provide indication of the fault condition, and require a manual reset (except undervoltage) before

restart. Undervoltage from a power loss shall be set to automatically restart after return to normal. The history of the previous three faults shall be retained in a fault buffer for later review.

2.8 CONSTRUCTION:

A. Provide NEMA configuration enclosure for each variable frequency drive system. The enclosure shall be either wall mounted or free standing, as required, with forced ventilation. Mount all components in a single enclosure including, but not limited to, the VFD unit, contactors, door interlocked circuit breaker, bypass/isolating equipment, and/or other items listed in the specification or shown on the drawings. All components shall be completely wired within the enclosure. Systems requiring mounting and interwiring of separate bypass enclosure are not acceptable. Limit overall size of unit to space allocated on the drawings. Verify code required clearance requirements before manufacture and installation of unit.

B. Indoor location: Provide NEMA 12 dust tight, non-ventilated enclosure, or NEMA 1 ventilated enclosure, ventilated by means of filtered air forced through the enclosure to create a positive internal pressure.

C. Outdoor location or location exposed to weather: Provide NEMA 4 (was down type), non-ventilated, enclosure. Locate all external heat sinks, fans, etc. associated with heat transfer in the rear of the enclosure with adequate stand offs for proper convection.

D. Mount the variable frequency drive ancillary components on a removable panel within the enclosure such that panel is removable from enclosure for maintenance and part replacement.

E. Provide "Machine Tool" type control transformer with primary and secondary fusing. All control power for operator devices and customer connections shall be 120 volts. Increase VA capacity of control transformer by a minimum of 10% when required to serve external impedances, safety interlocks or other control devices.

F. Permanently mark all system wiring with hot emboss stamping or an equivalent marking system. Identify all wiring and devices and match that identification in all system documentation (e.g. operation and maintenance manuals). Permanently mount system schematic wiring diagram on the interior of the VFD system enclosure.

G. Mount door with a minimum of two hinges with removable pins. Door shall be rigid and large doors shall have additional hinges and stiffening steel.

H. Provide door mounted, industrial type, oil tight operator devices similar to those found on motor control centers.

I. Paint enclosure with high grade epoxy (ANSI 61 Grey), a minimum of 50-70 microns thick.

J. Provide an electrical shock warning label to warn personnel that a potential of electric shock exists.

K. Provide screened or engraved labels on all door operator and pilot devices.

2.9 STANDARD FEATURES:

A. Provide the following standard features on all VFD units:

1. Motor Braking Torque shall be accomplished by means of DC injection into the motor or by regenerative braking.
2. The drive shall contain an output frequency clamp such that minimum or maximum output frequency can be set at desired limits.
3. Frequency Jump: The drive shall be supplied with frequency jump control to avoid operating at a point of resonance with the natural frequency of the machine.
4. Synchronous Transfer: Provide synchronous transfer feature to allow transfer of motor from VFD to the utility line and back to VFD operation while the motor is running.

B. Provide the following door mounted operator controls as a minimum:

1. Hand/Off/Auto switch
2. Local/Remote speed control
3. Frequency setting speed pot
4. Frequency indication meter calibrated in % speed.
5. Motor voltage indication
6. Motor current indication
7. VFD enable light
8. VFD fault light
9. External fault light (safeties interlock). If drive has an english character based display, this indication can be shown on that display in lieu of a pilot light.

C. Provide a minimum of the following protective features with an alarm display indication:

1. Instantaneous overcurrent
2. Motor stalled
3. Motor overload
4. Heatsink over temperature
5. Power loss
6. Output ground fault
7. Output short circuit
8. Loss of process speed signal (i.e. 4-20 ma.)
9. Microprocessor malfunction

D. Provide the following termination points on a terminal strip for field connection:

1. Safeties interlock connection
2. Remote Start/Stop connection
3. Remote VFD fault connection
4. Remote VFD/Bypass enable connection
5. Remote speed reference signal input (See item 10 below)
6. provide fan shutdown auxiliary contact for connection by the ATC contractor

E. Provide the following parameter adjustments to tune the VFD system:

1. Minimum and maximum speeds; maximum output voltage at output frequency
2. Acceleration and deceleration times (adjustable from 1 to 120 seconds, minimum)
3. Overcurrent trip point
4. Current limit response to overload
5. Adjustable carrier frequency to minimize audible motor noise.
6. DC boost to automatically (or manually, 3%) adjust boost voltage on each start to compensate for load changes.

F. The VFD shall be capable of starting into a rotating motor at any speed.

G. Remote signal connection terminals (0-5 VDC or 0-10 VDC = 0-100% speed or 4-20 ma = 20-100% Speed). Analog signals shall be programmable as normal or inverted.

H. The VFD shall have a programmable response to loss of a 4-20 ma signal. The following responses are acceptable.

1. Fault and stop the drive.
2. Alarm and maintain last reference (within 10%)
3. Alarm and go to preset speed
4. Alarm and go to minimum speed
5. Alarm and go to maximum speed

I. The VFD shall have a programmable analog output rated either 0-20 ma or 0-5 volts to represent one of the following:

1. Proportional to output frequency
2. Proportional to output current
3. Proportional to DC bus voltage
4. Proportional to output power

J. A programmable output offset shall be provided to allow modification of the analog output to obtain 2-10 volt DC or 4-20 ma.

K. The VFD shall have output relay contacts rated 115 volt AC/30 volt DC 5 amp resistive, 2 amp inductive. The contacts shall be:

1. Form A run contact
2. Form C fault contact
3. Form C alarm contact
4. Form A programmable contact to change state upon the following conditions: at speed, at frequency, at current, or at torque

L. Auto Restart: The VFD shall be provided with a feature for auto restart after a power failure. For maintenance purposes, the VFD shall be capable of starting, stopping, and running with stable operation with the motor completely disconnected (no load).

M. Bypass: Provide invertor with a manual bypass contactor arrangement for transfer to the feeder line to operate at constant speed. The contactors shall be electrically and mechanically interlocked and provided with an adjustable motor overload relay.

N. Isolation: Provide VFD isolation switch to allow maintenance on the VFD while operating in the bypass mode. It shall be pre-wired in the same enclosure and shall include contactors, input disconnect MCP, motor overload, VFD/Bypass selector switch, and Bypass ON light.

O. Provide VFD with transient voltage surge suppression with maximum UL 1449 suppression rating of 1000 amps, line to ground on 480 volt systems, and 500 amps, line to ground on 208 volt systems.

2.10 ADDITIONAL FEATURES: The following additional features shall be provided:

A. Metering

1. Digital or analog ammeter.

2. Digital or analog voltmeter.
3. Wattmeter.
4. Controls for manual forward/reverse motor operation.

B. Passive Harmonic Filter. Provide shunt tuned passive harmonic filter designed as to limit harmonic distortion at the input terminals of the VFD to the following values:

Maximum Harmonic Current Distortion (in Percent of input current):

	Individual Harmonic Order (Odd Harmonics)					
Harmonic:	Below 11	11-17	17-23	23-35	35 and above	TDD
Distortion:	12.0	5.5	5.0	2.0	1.0	15.0

Even harmonics shall be limited to 25% of odd harmonic limits.

C. Voltage Regulation. Provide voltage regulation on the incoming line side of the VFD equipment to prevent nuisance over-voltage trips.

D. Rated overload current upgraded to 150% for constant torque rated VFD's and 115% for variable torque rated VFD's. Hardware overcurrent shall be 225% of VFD's constant torque rating.

E. Provide several ports for remote control/monitoring of the drive functions.

2.11 TESTING:

A. Prior to shipping, test each unit and provide a certified test report with each unit. Standard tests shall include:

1. Visual inspection: Consisting of checking unit enclosure, wiring, connections, fasteners, covers and locking mechanism.
2. High pot test: Two (2)X rated voltage plus 1000 volts AC for 60 seconds shall be applied per UL 508 on all peripheral drive system power components (circuit breakers, contactors, motor overloads, line reactor, disconnect switches etc.) as a complete package. A copy of test results shall be included in operation manuals.

B. System run test under actual motor load.

C. Control panel devices: test all devices, lights, switches, etc.

D. Additional Equipment: test additional equipment specified with VFD system.

E. Special tests: as required and specified.

2.12 IDENTIFICATION:

A. Provide 1/16" black formica label with 1/4" high lettering on each VFD unit identifying the equipment served.

PART 3 – EXECUTION

3.1 MECHANICAL COORDINATION:

A. Meet with the supplier of the mechanical equipment and determine the exact characteristics of the motors for which VFD's are to be provided. Verify the exact control

requirements, including interface signal type, reversing/non-reversing drives, interlocks, etc.

B. Failure to coordinate compatibility does not relieve contractor of responsibility specified herein.

3.2 INSTALLATION OF VARIABLE FREQUENCY DRIVES:

A. Install variable frequency drives as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.3 MOTOR DISCONNECT INTERLOCK:

A. Where motor disconnect switches are installed on the load side of VFD's, provide late-make, early-break auxiliary contacts on each disconnect switch. Wire auxiliary contact to VFD safety contact, such that disconnecting the motor will shut down the drive first, and closing the switch will start the drive only after power is applied to the motor.

3.4 HARMONIC FILTERS:

A. Design shunt tune passive harmonic filters to prevent the importation of outside harmonics which could cause system resonance or filter failure. Calculations supporting the design, including a system harmonic flow analysis, must be provided as part of shunt tuned filter design documentation.

B. Coordinate designs which cause voltage rise at the VFD terminals with the total system voltage variations to eliminate nuisance tripping.

3.5 ADJUST AND CLEAN:

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.6 START-UP SERVICES:

A. The supplier of the AC drive described herein, shall provide field start-up service by an authorized factory trained service representative. The factory representative shall be trained in the maintenance and troubleshooting of the equipment as specified herein. Start-up service shall include system check-out, start-up and system run, and harmonic testing.

1. Verify that the input voltage is within the manufacturer's specification tolerances.
2. Verify that the motor rotation is correct in all modes of operation.
3. Verify all operator devices, programming and monitoring functions to be fully operational.
4. Verify operation of all field signal control connections.
5. Measure and record system output voltage and current at 50% and 100% speed. Tune the output voltage to correspond to motor nameplate data.
6. Make all parameter adjustments to tune and optimize the VFD system to the application. Record all configuration values as part of this report.
7. Conduct harmonic tests as identified below.

B. Provide owner training for each model and type of VFD system provided.

3.7 HARMONIC DISTORTION REPORT:

A. After installation is complete, measure the harmonic voltage and current distortion of each Variable Frequency Drive, with the VFD unit running at 50% operating speed and at highest operating speed. Take measurements on each phase (L-L and L-N) on the line side (input terminals) of the VFD.

B. Submit report which includes the following:

1. Data (text and graphical) showing voltage and current waveforms, voltage and current THD and individual harmonic spectrum analysis.
2. Power quality reports including telephone influence factor, true and displacement power factor, and voltage and current imbalance.

3. Provide the Engineer with two copies of the harmonic distortion report.

3.8 OPERATION AND MAINTENANCE MANUALS:

A. The vendor shall supply two complete manuals consisting of, as a minimum, general system arrangement, power wiring diagram, control wiring diagram, schematic of VFD System components and options, factory test reports, trouble shooting data, parts lists, and preventative maintenance information. Include the following:
1. functional operating description of the system, and detailed operating instructions.
2. bill of materials with listing of spare parts, parts availability, and ordering information
3. factory test reports
4. completed installation, commissioning and training approval forms
5. training certification form
6. power quality and harmonic voltage and current distortion report

3.9 WARRANTY
A. Provide a 3-year extended warranty, which shall cover the entire VFD system including power devices, controllers, filters, etc.

END OF SECTION 16156

SECTION 16160 - PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of panelboard and enclosure work, is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.3 QUALITY ASSURANCE:

A. Provide units which have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub No. 250, "Enclosures for Electrical Equipment (1000 volt maximum). Pub No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

B. SHOP DRAWINGS:

1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

PART 2 – PRODUCTS

ACCEPTABLE MANUFACTURERS:

2.1 MANUFACTURERS:

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

1. Siemens Energy and Automation
2. Cutler Hammer Products, Eaton Corp.
3. General Electric Company
4. Square D Company

2.2 PANELBOARDS:

A. GENERAL:

1. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip "spaces" with hardware to receive breaker or switch of size indicated. Provide CU/AL rated lugs of proper size to accommodate conductors specified.

B. POWER DISTRIBUTION PANELBOARDS:

1. Provide dead-front safety type power distribution panelboards as indicated, with switching and protective devices in quantities, ratings, types and with arrangement shown. Equip with aluminum bus bars, full-sized neutral bus and ground bus. Provide fusible or circuit breaker branch and main devices as indicated. Series rated systems are not acceptable. See Section 16180, Overcurrent Protection Devices.

C. LIGHTING AND APPLIANCE PANELBOARDS:

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown. Provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Series rated systems are not acceptable. Equip with aluminum bus bars, full-sized neutral bus, and ground bus.

D. PANELBOARD ENCLOSURES:

1. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage minimum 16-gage thickness. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein Bolt engraved formica labels indicating panel name and voltage on the interior and exterior of panelboards.

E. FINISH:

1. Coat interior and exterior of surface with manufacturer's standard color; baked on enamel finish.

F. IDENTIFICATION:

1. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the interior of each panelboard; include panelboard name and voltage. Provide red plastic laminate labels on emergency system panels.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS:

A. GENERAL:

1. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.

B. MOUNTING:

1. Provide 4" high concrete curb under floor standing distribution panelboards.

2. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosures firmly to walls and structural surfaces, ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Label circuit breakers to identify location of subpanel or equipment supplied using room numbers and equipment names. Include room number with equipment circuit designations. All directories to be typewritten.

END OF SECTION 16160

SECTION 16170 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedule. Work includes complete installations and electrical connections.

1.3 QUALITY ASSURANCE:

A. Provide motor and circuit disconnect switches which have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data including specifications, installation and general recommendations, for each type of motor and circuit disconnect switch required.

B. SHOP DRAWINGS: Submit dimensioned drawings of electrical motor and circuit disconnect switches which have rating of 100 amperes and larger.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

1. Cutler Hammer Products, Eaton Corp.
2. Siemens Energy and Automation
3. Square D Company
4. General Electric Company

2.2 FABRICATED SWITCHES:

A. GENERAL: Provide disconnect and safety switches as indicated herein. Provide:

1. General duty switches on 240 Volt rated circuits.
2. Heavy duty switches on 480 volt rated circuits.
3. HP rated switches on all motor circuits.

B. GENERAL DUTY SWITCHES: Provide general-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break mechanisms. Provide single phase or three phase and with solid neutral as

required by application. Equip with operating handle which is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.

C. HEAVY-DUTY SWITCHES: Provide heavy-duty type, sheet-steel enclosed safety switches, fusible or non-fusible as indicated, of types, sizes and electrical characteristics indicated; rated 600 volts, 60 hertz; incorporating quick-make, quick-break type mechanisms. Provide single phase or 3 phase, and with solid neutral as required by application, Equip with operating handle which is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application unless noted. Provide fusible switches with Class R rejection fuse clip kits.

D. FUSES: Provide fuses for switches, as required of classes, types and ratings needed to fulfill electrical requirements for service indicated. Provide spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. See Section 16180 Overcurrent Protective Devices for fuse types.

E. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect. Provide red plastic laminate labels on disconnects supplied with emergency power.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES:

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position.

D. For disconnect switches serving motors controlled by variable frequency drives, provide late-make, early-break auxiliary contacts on each disconnect switch. Wire auxiliary contact to VFD safety contact, such that disconnecting the motor will shut down the drive first, and closing the switch will start the drive only after power is applied to the motor.

END OF SECTION 16170

SECTION 16180 - OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of overcurrent protective device work is indicated by drawings and schedules. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 16175, Switchgear and Switchboards, and Section 16160, Panelboards.

B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:

1. Molded case circuit breakers
2. Power circuit breakers
3. Fusible switches
4. Fuses

C. Refer to other Division-16 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

B. SHOP DRAWINGS: Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.

C. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard

manufacturer):

B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:

1. Cutler Hammer, Inc.
2. General Electric Co.
3. Siemens Energy and Automation
4. Square D Co.

C. MOLDED CASE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.

D. FUSIBLE SWITCHES:

1. Provide factory-assembled fusible switch units for power distribution panelboards and switchboards, and individual mounting as indicated. Provide switch units of amperage, voltage, and RMS interrupting rating as shown, with quick-make, quick-break mechanisms, visible blades and dual horsepower ratings. Series rated systems are not acceptable. Equip with lockable handles with on-off indication. Interlock switch covers and handles to prevent opening in "ON" position. Provide switch with Class R rejection fuse clip kits. Provide AL/CU rated lugs of proper size to accommodate conductors specified.

2.2 FUSES

A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.

B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.

C. Provide and install spare fuse cabinet in main electrical room.

D. MAIN SERVICE AND FEEDER CIRCUITS: For fuse ratings over 600 amperes provide UL Class L Fuses (KRP-C, or A4BQ or LCL or KLPC). For fuse ratings up to 600 amperes, provide UL Class RK1 (KTN-R, KTS-R or A2K-R, A6K-R or NCCR, SCLR or KLN-R, KLS-R). If fuse directly feeds motors, transformers or other inductive load provide UL RK5 time delay (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECS-R or FLN-R, FLS-R).

E. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads, provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or

NCLR, SCLR OR KLNR, KLSR).

F. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussman Mfg. Co.
2. Gould Shawmut, Gould Electric Fuse Division
3. Reliance Fuse Div./Brush Fuse Inc.
4. Littlefuse, Inc.

G. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of all overcurrent devices which are furnished in separately mounted enclosures. Provide red labels for devices supplied with emergency power.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.

C. Where a neutral is supplied for equipment of gasoline pumps, install a disconnect/breaker to switch the neutral with the phase conductors when disconnect is opened.

D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

E. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.

F. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 16180

SECTION 16181 - TRANSFORMERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of transformer work is indicated by drawings and schedules. Work includes complete installation and electrical connections.

B. Types of transformers in this section include the following:

1. Liquid-filled transformers
2. Dry-type transformers

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to installation and construction of electrical power/distribution transformers; with applicable portions of NEMA Std. Pub. Nos. TR1 and TR27; and with applicable ANSI/IEEE standards pertaining to power/distribution transformers.

B. Comply with applicable portions of ANSI/UL 506; "Safety Standard for Specialty Transformers". Provide distribution transformers which have been UL listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on transformers, including certification of transformer performance efficiency, percentage regulation at 100 percent and 80 percent power factor, no-load and full load losses in watts, percent impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data. Before submitting product data, verify that dimensions of units to be supplied allow proper code required clearances adjacent to unit.

B. SHOP DRAWINGS: Submit dimensioned drawings of transformer installations, showing layout, mountings and supports, and spatial relationship to proximate walls and equipment.

C. MAINTENANCE STOCK FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every five installed units, but not less than three units of each (including ELSP fuses when specified).

PART 2 -PRODUCTS

2.1 POWER/DISTRIBUTION TRANSFORMERS: (OIL FILLED):

A. GENERAL: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

1. General Electric Company
2. Waukesha Electric Systems, General Signal Corp.
3. Cooper Power Systems, Cooper Industries
4. Standard/Balteau Transformer Div. Amer. Gage & Mach. Co.
5. Westinghouse Electric Corp.

C. OIL-FILLED DISTRIBUTION TRANSFORMERS: Provide factory-assembled, liquid-filled, outdoor type tamper-resistant, pad mounted distribution transformers where shown; of sizes, and characteristics indicated; 3-phase, 60-hertz and with ratings as follow:

1. Primary Voltage: 12,470 grd Y/7200, 95 KV BIL

2. Taps: Total of 4 - 2% to 2-1/2% increments, A & BN

3. Secondary Voltage: 277/480 Wye

4. Impedance: 3 Percent:

5. Windings: aluminum

6. Coolant: Insulating Oil

D. Provide externally operable, de-energized tap-changing operation. Limit transformer surface temperature rise to maximum 65 degrees C. Equip with high voltage terminations and provide equipment of dead front construction, conforming to ANSI C57.12,26 requirements. Provide one piece integrated bushings for use with elbow terminations and parking stands for mounting accessory equipment. Clamp bushings or wells externally. Arrange terminations/equipment for radial feed. Provide Bay-O-Net type oil immersed fuses in series with oil immersed ELSP current limiting fuses. Verify fuse size with manufacturer's recommendation. Equip with tank grounding provision in high and low voltage compartments. Provide low voltage bushings consisting of molded epoxy blade type spade terminals with standard hole spacing for vertical take off. Provide low voltage, insulated neutral, grounded to transformer tank; tie to primary and secondary neutrals of wye-wye systems by means of a removable link. Equip sealed transformer tank with drain and sampling valves, filter-press connection, magnetic oil gage with alarm contacts, automatic pressure relief device, grounding block, and top-oil dial type thermometer. Provide steel enclosure with hinged lift-off cabinet doors capable of locking. Equip with three elbow valve lightning arrestors, and high voltage compartment barrier. Apply manufacturer's standard blue-green outdoor enamel over cleaned and phosphatized steel enclosure.

2.2 POWER/DISTRIBUTION TRANSFORMERS (DRY-TYPE):

A. GENERAL: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

1. Acme Transformer Company
2. General Electric Company

3. Cutler Hammer Products, Eaton Corp.
4. ITE, Inc.
5. Federal Pacific
6. Challenger Electrical Equipment Corp.
7. Hevi-Duty Electric Div., General Signal Corp.
8. Jefferson Electric
9. Sorgel Electric Div./Square D Co.
10. Westinghouse Electric Corp.

C. DRY-TYPE DISTRIBUTION TRANSFORMERS (GENERAL PURPOSE): Provide factory-assembled, general-purpose, air-cooled, aluminum wound dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated. Provide primary winding with minimum of 4 full capacity taps; each 2-1/2 percent, two above and two below full-rated voltage for deenergized tap-changing operation.

D. Insulate with 220 degree C. UL recognized insulation system for 150 degree C rise above 40° ambient at full load.

E. Limit sound levels to the following (as determined by ANSI/NEMA standards):

1. 30-50 KVA 45 dB
2. 51-150 KVA 45 dB
3. 151-300 KVA 45 dB
4. 301-500 KVA 45 dB

F. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections. Equip terminal leads with connectors installed, suitable for copper or aluminum wiring. Cushion-mount transformer with vibration isolation supports. Provide transformers with ventilated, heavy gauge sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall and floor mounting as indicated.

PART 3 – EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Connect transformer units to electrical wiring system; comply with requirements of other Division-16 sections.

D. MOUNTING: Provide concrete pad under all floor mounted equipment and equipment mounted at grade. Anchor transformer to pad with 3/8" expansion anchors at each corner of enclosure. Provide vertical and lateral support systems for all transformers which are supported from overhead structure. See drawings for support and attachment details.

E. GROUNDING: Provide tightly fastened equipment grounding and bonding connections for transformers.

F. TESTING: Upon completion of installation of transformers, energize primary circuit at

rated voltage and frequency from normal power source and test transformers , including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 16181

SECTION 16452 - GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Provide grounding as specified herein, and as indicated on drawings.

B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.

C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.

D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.

E. Types of grounding in this section include the following:

1. Underground Metal Water Piping
2. Metal Building Frames
3. Grounding Electrodes
4. Grounding Rods
5. Separately Derived Systems
6. Service Equipment
7. Enclosures
8. Systems
9. Equipment
10. Other items indicated on drawings

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products which have been UL listed and labeled.

B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS:

A. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.

C. GROUND RODS: Steel with copper welded exterior, 3/4" dia. x 10' long. Weaver or Cadweld.

D. GROUND WELL BOXES FOR GROUND RODS: Precast concrete box 9-1/2" W. x 16" L. X 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "GROUND ROD".

E. CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND): #2/0 AWG bare copper conductor.

F. INSULATED GROUNDING BUSHINGS: Plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners, OZ/Gedney BLG, or Thomas & Betts #TIGB series.

G. CONNECTIONS TO PIPE: For cable to pipe, OZ/Gedney G-100B series or Thomas & Betts #390X series,, or Burndy type GAR.

H. CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES: For splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld or Thermoweld. If high compression type connectors are used for cable-to-cable, or cable-to-steel, or cable-to-ground rod connections, provide Thomas & Betts #53000 series, or Burndy Hyground series.

I. BONDING JUMPERS: OZ/Gedney Type BJ, or Thomas & Betts #3840 series, or Burndy type GG and type B braid.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.

B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.

C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding

conductor sized in accordance with NEC. Include copper grounding conductor in all raceway installed in suspended slabs.

D. Provide service entrance grounding by means of ground rods (quantity of two, driven exterior to building), by means of bonding to water main, and by means of bonding to building structural steel. In addition, provide a grounding electrode for not less than 30 lineal feet in concrete footing or foundation which is in direct contract with earth. Size electrode in accordance with NEC, but in no case, smaller than No. 4 AWG bare copper. Support electrode so as to be below finished grade near the bottom of the trench, and approximately three inches from the bottom or sides of the concrete. Locate a point of connection for inspection.

E. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.

3.2 GROUNDING ELECTRODES:

A. Separately Derived Electrical System Grounding Electrode: Ground each separately derived system per requirements in NEC Section 250-26 unless indicated otherwise.

B. GROUNDING ELECTRODE CONDUCTOR: Provide grounding electrode conductor sized per NEC table 250-94 or as indicated.

C. POWER SYSTEM GROUNDING: Connect the following items using NEC sized copper grounding conductors to lugs on the Service Ground Bus.

1. Grounding electrode conductor from ground rods.
2. Conductor from main incoming cold water piping system.
3. Conductor from building structural steel.
4. Ground for separately derived systems.

D. Run main grounding conductors exposed or in metallic conduit if protection or concealment is required.

E. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.

F. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system.

G. Provide bonding wire in all flexible conduit.

3.3 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified

under this Section.

B. Include typewritten records of measured resistance values in the Operation and Maintenance Manual.

C. Use independent testing agency for all testing.

D. Use test equipment expressly designed for the purpose intended. Submit name of testing agency for review and approval, in writing, to the Engineer prior to the performance of any testing.

END OF SECTION 16452

SECTION 16510 - INTERIOR AND EXTERIOR BUILDING LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of interior and exterior lighting fixture work is indicated by drawings and schedules.

B. Types of lighting fixtures in this section include the following:

1. High-Intensity-Discharge (HID)
2. Fluorescent
3. Incandescent/Halogen

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Comply with NEC 410-65C for all recessed incandescent light fixtures. Provide lighting fixtures which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on interior and exterior building lighting fixtures.

B. SHOP DRAWINGS:

1. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet. Submit all available standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided. Submit ballast manufacturer cut sheets. Submit a list of all lamps used on all projects.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):

1. HID MAGNETIC BALLASTS:

a. Advance Transformer Co.
b. Universal Lighting Technologies Co.
c. Venture Lighting International

2. INCANDESCENT AND FLUORESCENT LAMPS:

a. General Electric Co.
b. Osram Sylvania
c. Phillips Lighting Corp.

3. HID LAMPS:

a. General Electric Co.
b. Osram Sylvania
c. Phillips Lighting Corp.
d. Venture Lighting International

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

C. OUTDOOR FIXTURE FLUORESCENT LAMP BALLASTS – (MAGNETIC):

1. Provide magnetic, low-temperature starting fluorescent-lamp ballasts, capable of operating lamp types indicated; with high power factor, and low-noise features; Class P; sound-rated A, and with internal thermal protection. See plans for voltage requirements. Provide full light output energy conserving ballasts, where available as standard products, as follow:

a. Advance Transformer Co. - Mark III Series
b. Universal Lighting Technologies Co. - SLH-Watt Reducer Series

2. Comply with manufacturer's written recommendations for all lamp ballast combinations.

D. CBM LABELS:

1. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

E. BALLAST FUSING:

1. Provided in-line fusing for all fluorescent and HID ballasts. For fluorescent ballasts, provide GLR fuses and HLR -in-line fuse holders for each ballast. For HID fixtures provide KTK fuses and HPF fuse holders. Size fuses per ballast

manufacturer's recommendation.

a. Comply with manufacturer's written recommendations for all lamp ballast combinations.
b. Equip outdoor fixtures with low temperature starting ballasts.

F. FLUORESCENT LAMP BALLASTS: - (ELECTRONIC):

1. For interior fixtures, provide rapid start, fluorescent lamp ballasts capable of operating lamp types indicated, with power factor(ratio of actual power to apparent power) above 95%, and operating with audible noise level lower than the quietest C.B.M. certified ballast for the same application, listed as class A. Provide ballasts which comply with applicable state, federal, and industry standards and:

   a. Are UL listed,
   b. Comply with FCC requirements governing electromagnetic and radio frequency interference.
   c. Comply with IEEE standards for line voltage transient protection, and ANSI C.62.41 for location director A3 in the normal mode and location category A1 in the common mode.
   d. Comply with ANSI and IEEE standards for harmonic distortion

2. Light output shall not vary by more than 1% over a plus or minus 10% variation in line voltage, and shall not vary more than 5% of light output of equivalent C.B.M. certified ballast. See drawings and schedules for input voltage requirements. Ballasts shall consistently start and operate lamps from a supply line voltage of plus or minus 10% from nominal line voltage.

3. Provide ballasts which operate at a frequency above 20K hz from an input frequency of 60 hz; have an efficacy factor (relative light output per watt consumed) at least 10% above the C.B.M. certified electromagnetic system for the same application; and have a lamp crest factor (ratio of peak to R.M.S. lamp current) of 1.7 or less. Ballasts shall have a total current harmonic distortion of less than 20%.

4. All T5 and Compact electronic ballasts shall be programmed rapid start for maximum lamp life on shorter start cycles. Filament voltage shall be applied prior to the application of open circuit voltage to allow adequate heating of the filaments and then open circuit voltage is applied to start the lamps. Ballasts shall provide for a minimum lamp starting temperature of 0 degrees F. T8 ballasts shall be rapid start unless specified on the fixture schedule otherwise.

5. Ballasts for lamps of T5, T4, and T2 diameter shall contain end-of-life sensing circuitry to prevent lamp, lamp base, or socket damage at end-of-life.

6. Ballast manufacturer shall warrant ballasts for T8 and T5 lamps to be free from defects in material or workmanship for at least 5 years from date of manufacture. Ballasts for T4 and smaller shall be 3 years. Contractor shall provide warrantee in accordance with other sections of this specification. Warranty shall include an allowance for nominal replacement labor and replacement of defective product.

7. Comply with manufacturer's written recommendations for all lamp ballast combinations. Provide electronic ballasts of one of the following:

   a. Motorola

b. Advance Transformer Company
c. Howard Industries
d. Osram Sylvania
e. Universal Lighting Technologies Co.

G. CBM LABELS:

1. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

H. FLUORESCENT LAMPS:

1. Equip interior fluorescent fixtures with full light output, T8 lamps where available as standard products. Where applicable, equip fixtures with lamps as follows:

4' T8	2950	Initial Lumens

a. Sylvania Octron
b. General Electric
c. Phillips.

2. Provide fluorescent lamps with low levels of mercury, capable of acceptance of the Environmental Protection Agency (EPA) through the TCLP (Toxic Characteristic Leaching Procedure).

I. HIGH-INTENSITY-DISCHARGE-LAMP BALLASTS:

1. Provide HID ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly match lamps to power line by providing appropriate voltage and impedances for which lamps are designed. Equip exterior fixtures with low temperature starting ballasts. Provide high power factor, or power factor improved ballasts.

J. HID LAMPS:

1. Equip fixtures with HID lamps as specified. Provide coordinated lamp ballast combination to ensure full light output (rated lumens) of lamp. Where lamp manufacturer recommends operation of lamp in enclosed fixtures, provide suitable enclosure for fixtures specified. Include detailed drawing of enclosure with shop drawing submittal.

K. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of lighting

fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

D. Provide each lay-in light fixture with at least 36" (Not to exceed 72")of 3/8" steel flexible conduit.

E. Coordinate lighting in mechanical room with duct and equipment locations.

F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to insure fire rating of each ceiling in which fixtures are installed.

G. COORDINATION MEETINGS:

1. Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.

2. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.

H. ADJUST AND CLEAN:

1. Clean lighting fixtures of dirt and debris upon completion of installation.

2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.

I. SPARE PARTS:

1. Provide a spare set of diffusers (acrylic and/or glass only) for each fixture type and one for each additional 10 fixtures of each type; not to exceed 10 spares for any single fixture type.
2. In addition, furnish stock of replacement lamps amounting to 15 percent (but not less than one lamp) of each type and size used. Deliver replacement stock as directed to Owner's storage space.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.

C. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.

D. GROUNDING:

1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 16510

SECTION 16721 - FIRE ALARM AND DETECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. The fire alarm work includes the addition of new fire alarm initiating and alarm devices to the existing building fire alarm system. Modifications to existing equipment and control panels, new control equipment, power supplies, batteries and electronics shall be provided as required to increase the capacity of the existing system as required to serve the new devices, the increased number of horn/strobes, and the increased number of zones.

B. Provide a new fire alarm graphic plan of the building that includes the existing building zone identification and the new building addition zone identification.

C. Extent of fire alarm and detection systems work is indicated by drawings, schedules and as specified herein. Provide a minimum of four new zones: 1) east dance/exercise addition; 2) west classroom addition; 3) air handler duct detection; and 4) spare zone.

D. Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories. Provide components and systems which are UL-listed and labeled for fire alarm. Provide fire alarm and detection systems and accessories which are FM approved. Comply with State and local requirements as applicable.

E. Comply with applicable provisions of current NFPA Standards 72A for Local Protective Signaling Systems, 72B Auxiliary Protective Signaling Systems, 72C Remote Station Protective Signaling Systems (as applicable), local building codes, and meet requirements of local authorities having jurisdiction.

1.3 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.

B. SHOP DRAWINGS: Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams and riser diagrams of panel. Provide dimensioned drawing of Building Graphic.

C. CERTIFICATION: Submit a written statement to the Architect and the state and local Fire Marshal's Office that each device of the fire alarm system will be installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72.

D. Provide to the Fire Marshall's office the following:

1. A complete set of shop drawings indicating:

a. Location of all alarm-initiating and alarm-signaling devices.

b. Point-to-point wiring diagrams for all alarm-initiating and alarm-signaling devices.

2. Wiring diagrams for:

a. Alarm control panels.
b. Auxiliary function relays and solenoids.
c. Remote signaling equipment.
d. Standby battery calculations, including voltage drop calculation.

3. A complete equipment list identifying:

a. Type
b. Model
c. Manufacturer
d. Manufacturer catalog data sheets
e. UL Listing and/or FM approval showing compatibility of device with Fire Alarm Control Panel (FACP)

4. A complete zone list identifying all:

a. Alarm-initiating and alarm-signaling devices.
b. Remote signaling and auxiliary function zones.
c. Specific devices associated with each zone.

E. Submit to State and Local Fire Marshall, a complete Certificate of Compliance

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide fire alarm and detection equiment to match the existing system as follows:

1. Simplex Time Recorder Co.

2.2 FIRE ALARM AND DETECTION SYSTEMS:

A. GENERAL: Provide an electrically operated, electrically supervised fire alarm system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials which comply with Division 16, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.

B. SYSTEM TYPE: Analog, zoned, non-coded. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes all fire alarm signaling devices, sounding a non-coded alarm and providing device identification on an annunciator panel.

C. SYSTEM OPERATION: Provide system such that any manual station or automatic initiating device annunciates all alarm indicating units (bells, horns, buzzers, chimes, visual alarm lamps, etc.) continuously until the manual station or initiating device is restored to normal and the fire alarm control unit reset. Annunciate alarm signals by device at the control panel and all remote annunciators. Provide all conductors, raceway, equipment and labor to accomplish the following:

D. For fans which are not part of a smoke evacuation system, deactivate air supply and return fan units simultaneously by means of a supervised master fan shutdown relay with slave relays as required. Restart air units automatically after panel has been reset. Provide a bypass switch for master fan shut down relay for drill purposes, and indicate by a locked-in lamp that the circuit has been bypassed.

E. Release all magnetic door holders upon activation of an alarm from any device by use of a master relay in the control panel.

F. Provide supervised circuits for the following:

1. Close dampers upon activation of an alarm from any device through the HVAC interface relays.

G. Provide manual fire alarm stations in boiler rooms, and main administrative office. Provide external alarm horns sufficient to be heard in all parking areas.

H. Sprinkler Supervision. Provide a signal initiating and supervisory circuit to each PIV (post indicator) valve, and to each sprinkler riser and subdivision. Provide continuous alarm signal upon actuation of any water flow signal initiating device. Sound alarm until the condition has been corrected and the panel manually reset as required by UL864. Provide separate alarm zones for: (1) alarm zones from “waterflow alarms”, (2) alarm zones from “supervisory alarm” indicating sprinkler system trouble. Provide power to all alarm bells furnished under Division 15. Review final fire sprinkler drawings and coordinate for panel, flow and tamper switch locations.

2.3 SCOPE OF THE WORK:

A. Provide an addition to the existing building fire alarm system as previously specified and with new zones as required.

B. Provide all fire alarm devices as required to comply with codes.

C. Provide duct smoke detectors and fan relays at all fan units 2000 CFM and over. Shut down all supply and return fans upon a general alarm signal.

D. All initiating devices connected to the fire alarm control panel shall be analog addressable.

E. All wiring shall be in conduit (3/4" minimum). All conduit and connectors, shall be made of steel. All conduit runs shall form a complete loop from the fire alarm control panel.

F. Provide vandal resistant cages to protect smoke and heat detectors as shown on drawings, in gyms whether shown or not. Securely fasten security cages as required. Provide backing and bracing as required to insure that attachment extends beyond the ceiling materials. Cages shall have two pieces, one backplate and one cover to attach to backplate.

2.4 FIRE ALARM CONTROL PANEL:

A. The fire alarm control panel is an existing panel. Modify as required to add additional zones, alarm initiating an alarm indicating devices.

B. All alarm signals shall be locked in at the panel until the operated device is returned to its normal condition and the control panel is manually reset.

C. Each initiating and signal circuit shall be electrically supervised for opens, shorts, and ground faults in the wiring.

D. The occurrence of any fault shall activate the system trouble circuitry but shall not interfere with the proper operation of any circuit that does not have a fault condition.

E. The system loops shall be wired as Class "A" (Style 6) supervised circuits (a ground fault on either conductor or a break shall not prevent a device from operating on either side of the break).

F. Provide batteries capable of powering the entire system (existing and new devices) for (24) hours in standby condition and (5) minutes in alarm.

2.5 MONITOR MODULE:

A. Remote identification module devices shall be attached to any single normally open initiating device (heat detector, waterflow switch, duct detectors, sprinkler, tamper switches, kitchen hood, pull station, etc.). The modules shall supply addressing and status information to the Fire Alarm Control Panel through the dual loop module.

2.6 CONTROL POINT MODULE:

A. The control point module shall be connected to the same loop as the initiating devices, and shall provide a relay output (Form "C" 2 Amp @ 24 VDC, resistive only).

B. This relay output shall be used to perform auxiliary functions.

C. When the AOM is activated, the red "ACTIVE" LED shall be on solid. Under normal conditions, the red "ON LINE" LED shall flash.

2.7 DOOR HOLDER:

A. The door holder shall be wall mounted, semi-recessed; be powered at 120 VAC; and have 35 lbs. of holding force and be of a brushed aluminum finish.

2.8 MANUAL FIRE ALARM STATION:

A. Provide red enclosure, manual fire alarm stations with the following features:

1. Die-cast construction, for semi-flush mounting.
2. Electrically compatible with system requirements.
3. Double Action
4. Break glass design requiring unit to be opened for resetting, and requiring resetting before closing. Provide one spare “glass” for each manual station. Key reset, keyed like fire control panel.

2.9 IONIZATION SMOKE DETECTORS:

A. All ionization smoke detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All ionization fire detectors shall

be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.10 PHOTOELECTRIC DETECTORS:

A. All photoelectric detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All photoelectric detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.11 DUCT FIRE DETECTORS (WITH SAMPLING TUBE):

A. Provide ionization type with UL 268A listings. Each detector shall be equipped with a remote light. Each detector shall have (2) form "c" alarm contacts rated at 10 amps (at 120VAC).

2.12 BEAM SMOKE DETECTORS:

A. Provide projected beam smoke detectors, with each detector consisting of a transmitter head, receiver head and receiver control unit. The receiver head shall be capable of being located up to 100 feet from the receiver control unit.

2.13 THERMAL DETECTORS:

A. Thermal detectors shall operate on the Rate-of-Rise principal. The detectors shall have a fixed temperature rating of 135 degrees Fahrenheit. Exception: in Boiler rooms, provide temperature rating of 200 degrees Fahrenheit.

1. The heat detector shall consist of a base and a head.
2. The base shall be capable of accepting either a smoke detector or a 135 (or 200) gegree heat detector.
3. The head shall automatically restore to its normal standby condition when the temperature returns to its normal range.

2.14 AUDIOVISUAL ALARM HORNS:

A. Provide audio-visual alarm horns with the following features:

1. Die cast or stamped steel construction, finished in red enamel, suitable for indoor or ourdoor application.
2. Capable of 90 db (UL rating) sound level at 10 feet.
3. Flush mounted
4. Integrally mounted flashing light unit, with Lexan lens with block letters “FIRE”, and minimum flash rate of ONE per second, and 110 candela minimum.
5. Electrically compatible with system requirements.
6. Horns shall sound the temporal pattern (code 3) until silenced.
7. Audiovisual alarm horns shall have the ability to silence horns while maintaining the strobe flash, until reset.
8. Mechanical horn mechanism only, electronic horns are not acceptable.
9. Maximum 24 horns per circuit, maximum 8 strobes per circuit.

B. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

2.15 STROBES:

A. Provide strobe with flashing light unit, with Lexan lens with block letters “FIRE”, and minimum flash rate of ONE per second, and high intensity 110 candela minimum. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

2.16 PORTABLE PLUGABLE PHONE (FCI 3200): Not Required

2.17 AUXILIARY RELAY:

A. Remote auxiliary relay boards shall be rated at 10 AMPS @ 120 VAC. A red LED shall light to indicate relay activation. All relays shall transfer on general alarm and latch on until reset. All relays shall be supervised. The control output provided can be used in conjunction with fire alarm applications (i.e. fan controls, dampers, doors, and any other general alarm control).

2.18 INITIATING MODULES:

A. Provide style "6" initiating modules capable of receiving and annunciating an alarm from any detector, even with a single fault condition on any initiating circuit.

B. Power all smoke detectors from the "Style 6" initiating loop wiring. For systems which power smoke detectors separately from the "Style 6" loop, provide monitoring for both the power source and the independent initiating wiring, so that complete trouble and alarm indication is achieved by loop. Provide capability to operate all smoke detectors, even with a single fault condition on the smoke detector power wiring. Provide one spare initiating circuit.

2.19 SIGNALING MODULES:

A. Provide signaling as required. Provide power adequate to sound all signaling devices concurrently. Provide supervised indicating circuits for polarized 24V D.C. alarm signaling devices. Provide 2 spare signaling circuits.

B. Each signal circuit shall have a separate disconnect switch for servicing the fire alarm system. Each and every indicating circuit shall have a distinct location description. Power supply shall be at fire alarm control panel. Remote power supplies and indicating circuits will not be acceptable.

2.20 SUPPLEMENTAL NOTIFICATION CIRCUITS:

A. Provide supplementary notification appliance circuit panel(s) as required. The ‘SNAC’ shall be capable of supplying up to four Class A, Style Z notification appliance circuits. The panel shall contain its own battery charger, regulated power supply, and shall be supervised for ground fault, overcurrent, open circuits and low battery conditions. Ground fault, battery and circuit trouble conditions shall transmit a trouble signal to the main fire alarm control panel.

2.21 DOOR HOLDER POWER SUPPLY:

A. Door holders shall be powered by a power supply separate from the fire alarm system power supply. The power supply shall have its own battery back-up capable of holding all doors for a minimum of one hour on the loss of 120vac supply power.

2.22 BATTERIES/POWER SUPPLIES:

A. Provide standby batteries capable of operating fire alarm system for minimum of 24 hours, then operating all indicating units for at least five minutes. Locate batteries in fire alarm control unit, or in similar type enclosure located as directed. Provide all interconnecting wiring. Place batteries which vent hydrogen gas in separate enclosure. Provide 30 percent spare capacity.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "standard of installation".

B. All wiring shall be installed in conduit.

C. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 16 Basic Materials and Methods section, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings", and in accordance with other sections, as applicable.

D. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protective signaling circuit cable per NEC, Article 760.

E. If twisted or shielded wire is required or recommended by the manufacturer it must be used.

F. Review proper installation procedure for each type of device with equipment supplier before installation. Label each junction box throughout system, "fire alarm", and paint cover of junction boxes red.

G. Label circuit breaker feeding fire alarm panel: "Fire alarm system-do not turn off". Use plastic laminate label, white letters on red background.

H. Where smoke or heat detectors are specified, install device a minimum of three feet from adjacent air supply diffusers to ensure proper operation of device.

I. Refer to NFPA for spacing and exact placement of fire alarm devices.

PART 4 - FINAL ACCEPTANCE AND GUARANTEE

4.1 GUARANTEE:

A. Furnish a three-year guarantee for all equipment, materials and installation, including all labor, transportation, and equipment.

B. Emergency Response. The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

4.2 PRE-TEST:

A. The contractor shall with a representative of the manufacturer conduct a test 3 days before the final test to verify operation of all devices. Any problems must be corrected before the final test.

4.3 FINAL TEST:

A. Before the installation shall be considered completed and acceptable, a test on the system shall be performed as follows:

1. The contractor's job foreman, a representative of the manufacturer, a representative of the owner, shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel. Fan shutdown and door holder circuits shall operate.
2. Conduct a full 24 hour test of battery operation. System shall be put on the batteries for a full 24 hours and all notification appliances shall be operational for a period of 5 minutes.

B. The supervisory circuitry of the initiating and indicating circuits shall also be verified.

C. Provide the following spare devices:

1. 3 smoke detectors with base
2. 1 thermal detector with base
3. 3 strobe/horns
4. 2 manual pull stations with addressable modules

D. Provide 20 feet of conduit with wiring (completely installed and wired) for each spare device

PART 5 - AS BUILT DRAWINGS AND OPERATION AND MAINTENANCE MANUALS:

5.1 LABELING:

A. All devices shall be labeled with their appropriate address. The labels shall be 18 point pressure sensitive labels.

B. All initiating devices shall be programmed to include the device address and a complete user text English location description, i.e. Device L4S76, Smoke Detector, 1st floor Rm.17

5.2 AS BUILT DRAWINGS:

A. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all cost with bid.

B. A building map shall be supplied to the owner indicating the exact location of all zones or devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various devices and wiring by the use of different colors (minimum of five colors).

C. Provide a CD to the Owner containing the information specified below. The CD shall include all information required to allow the Owner to change the fire alarm program themselves. The CD shall contain a minimum of the following:

1. CAD drawing files of building fire alarm map.
2. CAD drawing files of as-built fire alarm components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.
5. Tutorial file on complete programming of fire alarm system.

5.3 OPERATING AND MAINTENANCE MANUALS:

A. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.

5.4 TRAINING:

A. Provide four (4) hours training on the operation and installation of fire alarm system, at job site, at no cost to owner.

B. Provide programming training and software sub-licensing in owner's name. Sub-licensing agreement shall include the U.L. requirement to allow the owner to do any programming that the supplier is allowed to do during commissioning, testing, service and field additions or deletions to the fire alarm system. The fire alarm supplier shall provide this training and licensing at no cost to the owner, including transportation (if outside Salt Lake City), lodging, meals, and training manuals.

END OF SECTION 16721

SECTION 16740 – TELEPHONE/DATA SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. The extent of telephone system work is indicated by drawings and is hereby defined to include, but not be limited to raceway, outlets, device plates, backboards, grounding and miscellaneous items required for complete raceway system and cables

B. Refer to other Division-16 sections for requirements for raceways, trays, boxes and fittings, wiring devices (plates), and supporting devices, and other sections, as applicable.

1.3 QUALITY ASSURANCE:

A. Comply with applicable portions of NEC as to type products used and installation of components. Provide products and materials which have been UL-listed and labeled.

PART 2 - PRODUCTS

A. GENERAL: Provide complete raceway system for telephone including but not limited to, raceway, outlets, device plates, backboards, grounding and miscellaneous items as required.

B. Provide 4" square box with appropriate plaster or tile ring.

C. Provide telephone coverplates for wall outlets to match color and material of wiring device plates; for floor outlets, match color and material of floor power outlet covers.

D. Provide fire treated, or hypalon coated plywood terminal backboards, 4' x 8' x ¾" unless noted otherwise.

E. Provide terminal cabinets of code gauge steel, flush or surface, as indicated, with concealed trim clamp, concealed hinges and flush lock, with gray baked enamel finish to match finish of panelboard covers. Construct back boxes of code gauge galvanized steel with removable endwalls.

PART 3 - EXECUTION

3.1 INSTALLATION OF TELEPHONE SYSTEM:

A. GENERAL: Install raceway system as indicated to comply with NEC and recognized industry practices. Run ¾" conduit from each telephone outlet to terminal backboard, tray, or terminal cabinet. Run a minimum of one 3/4" conduit from terminal backboard or cabinet to the fire alarm control panel. Provide nylon pull cord in all empty raceway.

B. GROUNDING: Provide one #6 bare copper ground from each telephone terminal board to the service entrance ground. Enclose in suitable raceway for entire length. Coil six feet of conductor at each terminal board. Make connection at service entrance ground.

See drawings for additional requirements.

C. POWER: Provide a minimum of four duplex receptacles on two dedicated circuits adjacent to each terminal backboard or cabinet. See drawings for additional power outlets.

END OF SECTION 16740