STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

Request For Bids For Construction Services

Two-Stage Bidding Process

Stage II – General Contractors Bidders List
Invitation to Bid

March 2, 2006

STUDENT STUDY AREA INFILL SPACE

UTAH VALLEY STATE COLLEGE

OREM, UTAH

DFCM Project No. 05264790

Axis Architects
610 I Street
Salt Lake City, Utah 84103

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM:

DFCM General Conditions dated May 25, 2005
DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:
Drawings:

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

INVITATION TO BID

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

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

STUDENT STUDY AREA INFILL SPACE
UTAH VALLEY STATE COLLEGE – OREM, UTAH
DFCM PROJECT NO: 05264790

Project Description: Construct a 900 square foot addition where the McKay Events Center hallway intersects with the Physical Education Building. Construction cost estimate: $150,000.00

FIRM NAME	POINT OF CONTACT	PHONE	FAX
ABCO Construction, Inc.	Mr. Reed Price	(435) 723-3770	(435) 723-3311
Ascent Construction	Mr. Dan Wall	(801) 299-1711	(801) 299-0663
Bellock Construction, Inc	Ms. Melody Bellock	(801) 277-7805	(801) 277-5751
Broderick and Henderson Const	Mr. Gary Broderick	(801) 225-9213	(801) 225-4697
Cal Wadsworth Construction	Mr. Cal Wadsworth	(801) 208-1957	(801) 208-1975
Chad Husband Construction, Inc	Mr. Richard Marshall	(801) 972-1146	(801) 886-1784
Comtrol Inc.	Mr. Ralph B. Burk	(801) 561-2263	(801) 561-2305
Darrell Anderson Construction	Mr. James Anderson	(435) 752-6860	(435) 752-7606
Garff Construction	Mr. Phil Henriksen	(801) 973-4248	(801) 972-1928
Gramoll Construction	Mr. Ken Romney	(801) 295-2341	(801) 295-2356
Jepson Construction	Mr. Rick Jepson	(801) 774-8860	(801) 773-8980
Keller Construction	Mr. S. Daniel Hill	(801) 972-1018	(801) 972-1063
McCullough Engineering	Mr. Jim McCullough	(801) 466-4949	(801) 466-4989
Saunders Construction	Mr. Edward Saunders	(801) 782-7830	(801) 782-7856
Spectrum Construction of Utah	Mr. Ronald Snowden	(801) 915-6222	(801) 607-2203
Valley Design and Construction	Mr. Corey King	(801) 927-9542	(801) 927-9544
Wade Payne Construction, Inc.	Mr. Wade Payne	(801) 226-6144	(801) 226-7772

The bid documents will be available on Thursday March 2, 2006 in electronic format from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801) 538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Kurt Baxter, Project Manager, DFCM, at (801) 538-3174. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 2:00 PM on Tuesday, March 7, 2006 in Room 147 of the Physical Education Building at Utah Valley State College in Orem, Utah. All short listed prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 2:30 PM on Thursday, March 16, 2006 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah. A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

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

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

STAGE II BIDDING PROCESS

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

Invitation to Bid: DFCM will notify each short-listed firm via e-mail and/or fax when a project is ready for construction services.

Bid Documents: Bidding documents including plans and specifications (if applicable) may be obtained by accessing DFCM's web page at http://dfcm.utah.gov or at DFCM's office 4110 State Office Building, Salt Lake City, Utah 84114.

Mandatory Pre-Bid Site Meeting: If required, the schedule contained in this document will indicate the date, time, and place of the mandatory pre-bid site meeting. At this meeting, contractors will receive additional instructions about the project and have an opportunity to ask questions about project details. If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project.

Written Questions: The schedule contained in this document will indicate the deadline for submitting questions in writing to the DFCM Representative pertaining to this project.

Final Addendum: The schedule contained in this document will indicate the deadline for DFCM issuing the final addendum clarifying questions and changes to the scope of work. Contractors are responsible for obtaining and responding to information contained in the addenda.

Submitting Bids: Bids must be submitted to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule contained in this document. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule. (Additional information pertaining to bidding is contained later in this document). It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document. (Additional information pertaining to subcontractor lists is contained later in this document)

2. Drawings and Specifications, Other Contract Documents

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

3. **Bids**

Before submitting a bid, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. 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 Notice to Contractor's prior to the published deadline for the submission of bids.

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

If the bid bond security is submitted on a bid bond form other than the 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.**

4. **Contract and Bond**

The Contractor's Agreement will be in the form bound 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.

5. **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 contract for a period of up to three years.

6. **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 Representative 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 duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither 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.

7. **Addenda**

Any Addenda issued during the time of bidding shall become part of the Contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

8. **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. The 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.

9. **DFCM Contractor Performance Rating**

DFCM will evaluate the performance of the Contractor. This evaluation may include comments from the User. The Contractor will have an opportunity to review and comment on the evaluation. Evaluations, including the Contractor's comments, may be considered in future selection in the evaluation of the Contractor's past performance.

10. **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.

11. **Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

12. **Time is of the Essence**

The completion deadline for this project is **August 10, 2006.** Failure to meet the completion deadline may result in a poor performance rating from DFCM which may have a negative impact on your firm's ability to obtain future work with the state of Utah and may also result in liquidated damages being assessed. Time is of the essence in regard to all the requirements of the Contract Documents.

13. **Withdrawal of Bids**

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

14. **Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed

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

15. **Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

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

16. **Debarment**.

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

PROJECT SCHEDULE

Stage II = Two-Stage Bidding Process

PROJECT NAME: STUDENT STUDY AREA INFILL SPACE
UTAH VALLEY STATE COLLEGE – OREM, UTAH
DFCM PROJECT # 05264790

Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Thursday	March 2, 2006	9:00 AM	DFCM, 4110 State Office Building, SLC, UT and DFCM web site *
Mandatory Pre-bid Site Meeting	Tuesday	March 7, 2006	2:00 PM	Room 147 Physical Education Building Utah Valley State College Orem, UT
Last Day to Submit Questions	Friday	March 10, 2006	4:00 PM	DFCM, 4110 State Office Building, SLC, UT
Final Addendum Issued	Tuesday	March 14, 2006	4:00 PM	DFCM, 4110 State Office Building, SLC, UT or DFCM web site*
Prime Contractors Turn in Bid and Bid Bond / Bid Opening in DFCM Conference Room	Thursday	March 16, 2006	2:30 PM	DFCM, 4110 State Office Building, SLC, UT
Subcontractors List Due	Friday	March 17, 2006	2:30 PM	DFCM, 4110 State Office Building, SLC, UT
Project Completion Date	Thursday	August 10, 2006	5:00 PM	

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

BID FORM

NAME OF BIDDER _____ DATE _____

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

The undersigned, responsive to the "Notice to Contractors" and in accordance with the Request for Bids for the **STUDENT STUDY AREA INFILL SPACE – UTAH VALLEY STATE COLLEGE – OREM, UTAH – DFCM PROJECT NO. 05264790** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

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

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

I/We guarantee that the Work will be Substantially Complete by **August 10, 2006** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$300.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

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

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

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

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

BID BOND

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

KNOW ALL PERSONS BY THESE PRESENTS:

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

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

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

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

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

DATED this _____ day of _____, 20_____ .

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

_____

_____

By:_____

Title: _____

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

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

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

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

_____
NOTARY PUBLIC

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

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

INSTRUCTION AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, 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 SUBCNTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

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

We certify that:

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

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR 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 within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONTRACTOR: _____

_____
Signature Date

Title: _____

_____
Please type/print name clearly

State of _____)
)
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 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:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
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 7b-2 012405

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 7b-2 012405

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

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

DFCM FORM 052505

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

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

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

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

_____

_____

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

☐ Record Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

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

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

_____	by:	_____	
CONTRACTOR (include name of firm)		(Signature)	DATE
_____	by:	_____	
A/E (include name of firm)		(Signature)	DATE
_____	by:	_____	
USING INSTITUTION OR AGENCY		(Signature)	DATE
_____	by:	_____	
DFCM (Owner)		(Signature)	DATE

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

cc: Parties Noted
DFCM, Director

Project Document Generated by MASTERWORKS: February 06, 2006

Project Manual

Project Number 0510
DFCM PROJECT # 05264790

UTAH VALLEY STATE COLLEGE
HALLWAY STUDY AREA INFILL

January 15, 2006

Axis Architects

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END OF INDEX TO PROJECT MANUAL

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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: UVSC Hallway Addition.

1. Project Location: Located within the Physical Education Building on the campus of UVSC in Orem, Utah.

B. Owner: UVSC.

C. Project Number: DFCM 05264790.

D. Architect: Axis Architects.

E. Construction Manager:

1. A Construction Manager will be engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and Contractor, according to a separate contract between Owner and Construction Manager.
2. Construction Manager for this Project is Project's Constructor. In Divisions 1 through 16 Sections, the terms "Construction Manager" and "Contractor" are synonymous.

F. The Work consists of the following:

1. The Work includes all of the work of Divisions 01 thru 16 for the UVSC Hallway addition within the Physical Education building project.

1.4 TYPE OF CONTRACT

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

1.5 WORK PHASES

A. The Work may be conducted in phases, with each phase substantially complete before beginning the next phase:

B. Before commencing Work of each phase, submit a schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner will award separate contract(s) for other construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

C. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

D. Future Work: Owner will award separate contract(s) for the following additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1.7 PRODUCTS ORDERED IN ADVANCE

A. General: Owner has negotiated Purchase Orders with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Purchase Orders to Contractor. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the Contract Sum.

1. Contractor's responsibilities are same as if Contractor had negotiated Purchase Orders, including responsibility to renegotiate purchase and to execute final Purchase-Order agreements.

1.8 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

1.9 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

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

1. Limits: Confine construction operations to Contract limits.

   a. Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 5 feet (1.5 m) beyond primary roadway curbs, walkways, and main utility branch trenches; and 25 feet (7.6 m) beyond pervious paving areas.

2. Owner Occupancy: Allow for Owner occupancy of Project site.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

   a. Schedule deliveries to minimize use of driveways and entrances.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.10 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing adjacent 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.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

C. Owner Occupancy of Completed Areas of Construction: 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 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.

1.11 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours, except otherwise indicated.

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 two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

    a. Implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01100

PART 1) - GENERAL

a) SUMMARY

i) Definitions: Basic Contract definitions are included in the General Conditions.

(1) Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

(2) Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.

(3) Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

(4) Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

(5) Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

ii) Specification Format and Conventions:

(1) Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC=s AMasterFormat@ numbering system.

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

b. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

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

(a) 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.

(b) Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, hte

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.

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

iii) Drawing Symbols:

(1) Graphic symbols: Where not otherwise noted, symbols are defined by "Architectural Graphic Standards," published by John Wiley & Sons, Inc., eighth edition.

(a) Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical Drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by more specific symbols recommended by technical associations including ASME, ASPE, IEEE, and similar organizations. Refer instances of uncertainty to the Architect for clarification before proceeding.

PART 1 - Industry Standards:

1. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Project Site for reference.
2. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.
3. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.
4. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
   a. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
   b. Although copies of standards needed for enforcement of requirements also may, be included as part of required submittals, the Architect reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.
5. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.
   a. A copy of the CSI directory of Construction Industry Associations, Societies, and Institutes, and Abbreviations is on file in the office of the Architect.

END OF SECTION 01190

SECTION 01230 - ALTERNATES February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1 – Vent Piping:

1. Provide all material, equipment and labor as required to replace the existing PVC vent pipe with new cast iron piping. Base bid shall include new cast iron piping as shown on the drawings.

END OF SECTION 01230

SECTION 01250 - CONTRACT MODIFICATION PROCEDURES February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

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

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
   A. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   B. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   C. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

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

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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.

1.5 CHANGE ORDER PROCEDURES

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

SCHEDULE 6 - CONSTRUCTION CHANGE DIRECTIVE

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

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

PRODUCT DATA SHEET 1 - Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

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

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01250

SECTION 01290 - PAYMENT PROCEDURES February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of

Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.
2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

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

1. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
      1. Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. 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.

8. 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.

SCHEDULE 5 - APPLICATIONS FOR PAYMENT

. 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.

A. 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.

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

C. 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.

D. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. 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.

E. 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.

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

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

G. 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.

PRODUCT DATA SHEET 8 - 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:

1.1 Evidence of completion of Project closeout requirements.
1.2 Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
1.3 Updated final statement, accounting for final changes to the Contract Sum.
1.4 AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
1.5 AIA Document G706A, "Contractor's Affidavit of Release of Liens."
1.6 AIA Document G707, "Consent of Surety to Final Payment."
1.7 Evidence that claims have been settled.
1.8 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.
1.9 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 February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination Drawings.
   4. Administrative and supervisory personnel.
   5. Project meetings.

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

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: Coordinate construction operations included in various Sections of the

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

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.

SCHEDULE 6 - PROJECT MEETINGS

. 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.

A. 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.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction. Including, but no limited to: Demolition, concrete, masonry, excavation, mechanical, plumbing, electrical, steel erection and stud framing, roofing drywall and finish work.

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.

PRODUCT DATA SHEET 3 - Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   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.

1.3 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.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Daily construction reports.
   4. Material location reports.
   5. Field condition reports.
   6. Special reports.

B. Related Sections include the following:
   1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   2. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   3. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

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

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

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

F. Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

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

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

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

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 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 and Construction Manager's final release or approval.

B. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

C. CPM Reports: Concurrent with CPM schedule, submit three 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 in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Total Float Report: List of all activities sorted in ascending order of total float.
   3. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

D. Daily Construction Reports: Submit one copy at weekly intervals.

E. Material Location Reports: Submit two copies at monthly intervals.

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

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

1.5 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.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

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

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

2.2 REPORTS

D. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Major material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
15. Construction or Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

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

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

2.3 SPECIAL REPORTS

G. General: Submit special reports directly to Owner within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

I. 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 monthly.
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.

PRODUCT DATA SHEET 10 - Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1.1 Post copies in Project meeting rooms and temporary field offices.

1.2 When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 01330 - SUBMITTAL PROCEDURES February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
2. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
3. Division 1 Section "Closeout Procedures" for submitting warranties.
4. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Division 1 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
7. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

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

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

1.4 SUBMITTAL PROCEDURES

A. 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: Provide a prioritized schedule of submittals.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days for review of each resubmittal.
   4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.

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 5" x 10" on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   3. Include the following information on label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Architect and Construction Manager.
      d. Name and address of Contractor or Subcontractor.
      e. Name and address of supplier.

f. Name of manufacturer.
g. Number and title of appropriate Specification Section.

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

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

G. Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Construction Manager.
1. Transmittal Form: Use regular transmittal form.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Conforms@.

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

J. Use for Construction: Use only final submittals with mark indicating "Conforms" taken by Architect and Construction Manager.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

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

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

M. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Wiring Diagrams:
         1) Differentiate between manufacturer-installed and field-installed wiring.

2) Show field-installed wiring, including power, signal, and control wiring.

f. Shopwork manufacturing instructions.

g. Templates and patterns.

h. Schedules.

i. Design calculations.

j. Compliance with specified standards.

k. Notation of coordination requirements.

l. Notation of dimensions established by field measurement.

m. Relationship to adjoining construction clearly indicated.

n. Seal and signature of Utah registered professional engineer if specified.

o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. 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 42 inches (750 by 1000 mm).

3. Number of Copies: Submit copies of each submittal, as follows:

a. One set of reproducible vellums and five (5) copies.

b. Must be reviewed, approved, stamped, signed and dated by Construction Manager.

c. Show Specification Section Number (from Project Manual).

d. Show Contractor-s name, address, telephone and fax numbers and Contact Person.

e. Construction Manager:

1) Shall receive back his one set of reproducible vellum drawings and one print copy, as reviewed by the Architect and/or Engineer.

2) Construction Manager is responsible for print sets and distribution of same.

3) Shop Drawing originals belong to the Construction Manager and shall remain in his files.

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.

b. Product name and name of manufacturer.

c. Sample source.

d. Number and title of appropriate Specification Section.

3. 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.

4. 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.
   a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return one submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or 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.
   a. Number of Samples: Submit three (3) sets of Samples. Architect will retain one (1) Sample set; remainder will be returned.
      1. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

O. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product.
   2. Number and name of room or space.
   3. Location within room or space.
   4. Number of Copies: Submit five (5) copies of product schedule or list, unless otherwise indicated. Architect will return three (3) copies.
      a. Mark up and retain one returned copy as a Project Record Document.

P. Delegated-Design Submittal: Comply with requirements in Division 1 Section AQuality Requirements@.

Q. Submittals Schedule: Provide a prioritized schedule of submittals.

R. 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

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

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

U. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

V. 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.

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

X. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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

Z. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

AA. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

BB. 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 in the Contract Documents.

CC. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. 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.

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

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

EE. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

FF. 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 in the Contract Documents.

GG. 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.

HH. 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 in the Contract Documents.

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

JJ. 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.

KK. 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.

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

MM. 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.

NN. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
1. Architect will not review submittals that include MSDSs and will return them with no action taken.

2.3 DELEGATED DESIGN

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

indicated.

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

PP. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S REVIEW

QQ. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with review stamp before submitting to Architect.

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

3.2 ARCHITECT'S ACTION

SS. General: Architect will not review submittals that do not bear Construction Manager's review stamp and will return them without action.

TT. 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, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal AConforms@ the

work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal ARe: Notes@, the work covered by the submittal may proceed provided it complies with the notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned For Resubmittal: When the Architect marks a submittal ARevise and Resubmit@, do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

   A. Do not use, or allow others to use, submittals marked ARevise and Resubmit@, at the Project Site or elsewhere where work is in progress.

1.4 Returned For Alternate Submittal: When Architect marks a submittal ADoes Not Conform@, do not proceed with work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Product was not appropriate or as specified. Prepare a new submittal according to the Contract Documents.

PRODUCT DATA SHEET 47 - Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

PRODUCT DATA SHEET 48 - Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

PRODUCT DATA SHEET 49 - Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01400 - QUALITY CONTROL SERVICES February 6, 2006

PART 1) - GENERAL

a) SUMMARY

i) This Section specifies administrative and procedural requirements for quality control services.

ii) Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

iii) Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
   (1) Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities.
   (2) Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

iv) Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

v) Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

b) RESPONSIBILITIES

i) Contractor Responsibilities:
   (1) Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services shall be included in the Contract Sum.
      (a) Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor=s responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
      (b) Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner=s responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
   (2) Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

(3) Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

(4) Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

(a) Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

(b) Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

(c) Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

(d) Security and protection of samples and test equipment at the Project site.

ii) Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.

(1) The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

iii) Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

(1) The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

(2) The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

(3) The agency shall not perform any duties of the Contractor.

iv) Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

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

c) SUBMITTALS

i) The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate

(1) Submit additional copies of each written report directly to the governing authority, when the authority so directs.

(2) Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
- (a) Date of issue.
- (b) Project title and number.
- (c) Name, address and telephone number of testing agency.
- (d) Dates and locations of samples and tests or inspections.
- (e) Names of individuals making the inspection or test.
- (f) Designation of the Work and test method.
- (g) Identification of product and Specification Section.
- (h) Complete inspection or test data.
- (i) Test results and an interpretations of test results.
- (j) Ambient conditions at the time of sample-taking and testing.
- (k) Name and signature of laboratory inspector.
- (l) Recommendations on retesting.

d) QUALITY ASSURANCE

i) Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

(1) Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2) - PRODUCTS

(Not Used)

PART 3) - EXECUTION

a) TESTS REQUIRED

i) Tests required may include but not be limited to the following:
- (1) Soil compaction per IBC 1802.6.
- (2) Concrete, per IBC 1704.4 and Table 1704.4.
- (3) Welding, per IBC 1704.3 and Table 1704.3.
- (4) High strength bolts, per IBC 1704.3.3.
- (5) Structural masonry, per IBC 1704.5.
- (6) Spray-on fireproofing, per IBC 1704.11.
- (7) Smoke-control system, per IBC 1704.14.

b) REPAIR AND PROTECTION

i) General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

(1) Protect construction exposed by or for quality control service activities, and protect repaired construction.

(2) Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:
1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.
9. Facsimile machine.

C. Support facilities include, but are not limited to, the following:
1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary elevator usage.
9. Temporary stairs.
10. Construction aids and miscellaneous services and facilities.

11. First aid station.

D. Security and protection facilities include, but are not limited to, the following:
1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Covered walkways.
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

E. Related Sections include the following:
1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Division 1 Section "Execution Requirements" for progress cleaning requirements.
3. Divisions 2 through 16 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

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

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

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

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

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

1.5 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

1.6 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

E. Lumber and Plywood: Comply with requirements in Division 6 Section "Miscellaneous Carpentry."

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

G. Water: Potable.

2.2 EQUIPMENT

H. General: Provide equipment suitable for use intended.

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

J. 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.

K. 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.

L. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

M. 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.

N. 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.

O. 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

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

Q. 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

R. 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.

S. Sewers and Drainage: Provide temporary connections to remove effluent that can be discharged lawfully.

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

T. 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.

U. 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. 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).

V. 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.

W. 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.

X. 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 power distribution wiring overhead and rise vertically where least exposed to damage.
2. Connect temporary service to Owner's existing power source, as directed by electric company officials.

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

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

Z. 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.

AA. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
1. Provide additional telephone lines for the following:
   a. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
   b. Provide a dedicated telephone line for each facsimile machine and computer with modem in each field office.
   c. Provide a separate telephone line for Owner's use.
   d. Install a telephone on every second or third story of construction.
2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect's office.
   e. Engineers' offices.
   f. Owner's office.
   g. Principal subcontractors' field and home offices.
3. Provide an answering machine or voice-mail service on superintendent's telephone.
4. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

BB. 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.

CC. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the

top 6 inches (150 mm).

2. Provide gravel paving course of subbase material not less than 3 inches (75 mm) thick; roller compacted to a level, smooth, dense surface.
3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

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

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

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

FF. 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.
5. Provide one 72" high x 96" wide project sign with text as follows:
   a. Name of Project - allow 2 line.
   b. Name of Owner - allow 2 lines.
   c. Owner=s Logo - allow 24" x 16" space.
   d. Name of Architect - allow 4 lines.
   e. Architect=s Logo - allow (2) 24" x 16" spaces.
   f. Name of Contractor - allow 2 lines.
   g. Contractor=s Logo - allow 24" x 16" space.
   h. Allow 24 additional lines.

GG. Waste Disposal Facilities:

1. Establish a system for daily collection and disposal of waste or extraneous materials from all construction areas on site that may present a hazard to the project, its craftsmen and the expeditious construction of the work. The Contractor shall provide to the Owner a satisfactory method to assure clean-up is

performed in a timely and expeditious fashion. Enforce requirements strictly. Do not hold collected materials at the site longer than 7 days during normal weather or 3 days when the daily temperature is expected to rise above 80 degrees F. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.

a. Burying or burning of waste materials on the site will not be permitted.

b. Washing waste materials down sewers or into waterways will not be permitted.

c. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of lunch garbage and similar wastes by construction personnel.

2. The Owner reserves the right to withhold payments and perform the clean-up, if necessary, at the expense of the Contractor, if unsatisfactory clean-up efforts are not performed in a timely fashion.

HH. 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 12 persons at Project site. Keep office clean and orderly.

1. Furnish and equip offices as follows:

a. Desk and four chairs, four-drawer file cabinet, a plan table, a plan rack, and bookcase.

b. Provide a room of not less than 240 sq. ft. (18.0 sq. m) for Project meetings. Furnish room with conference table, 12 folding chairs, and 4-foot- (1.2-m-) square tack board.

2. Provide resilient floor covering and painted gypsum wallboard walls and acoustical ceiling. Provide operable windows with adjustable blinds and insect screens.

3. Provide an electric heater with thermostat capable of maintaining a uniform indoor temperature of 68 deg F (20 deg C). Provide an air-conditioning unit capable of maintaining an indoor temperature of 72 deg F (23 deg C).

4. Provide fluorescent light fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height. Provide 110- to 120-V duplex outlets spaced at not more than 12-foot (4-m) intervals, 1 per wall in each room.

II. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

JJ. 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.

KK. Temporary Elevator Usage: Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged

work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

LL. Temporary Stairs: 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

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

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

OO. 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.

PP. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

QQ. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Set fence posts in concrete bases.
2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

RR. 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.

SS. 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.

TT. Covered Walkway: Where required, erect a structurally adequate, protective, covered walkway for passage of persons along adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

UU. 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.

VV. 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. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

WW. 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 temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

YY. 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.

PRODUCT DATA SHEET 52 - 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.

PRODUCT DATA SHEET 53 - 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.

1.1 Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.

1.1

1.2 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.

1.3 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 February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 1 Section "Definitions and Standards" for applicable industry standards for products specified.
   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. 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.

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.

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. 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

D. 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.

E. 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 Products" 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

F. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

G. 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

PRODUCT DATA SHEET 8 - Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1.1 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.

1.2 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.

1.3 Evidence that proposed product provides specified warranty.

1.4 List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

1.5 Samples, if requested.

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. General installation of products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.
   7. Correction of the Work.

B. Related Sections include the following:
   1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. Division 1 Section "Submittal Procedures" for submitting surveys.
   3. 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.
   4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

B. 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.

C. 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.

D. 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

E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied 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 two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's and Owner's written permission.

F. 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.

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

H. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

I. 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.

J. General: Engage a land surveyor/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 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.

K. 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.

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

3.4 FIELD ENGINEERING

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

N. 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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

O. 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

P. 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.
1.
4. Maintain minimum headroom clearance as indicated in spaces without a suspended ceiling.

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

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

S. 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.

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

U. 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.

V. 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.

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

3.6 PROGRESS CLEANING

X. 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.

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

Z. 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.

AA. 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.

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

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

DD. 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.

EE. 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.

FF. 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.

GG. 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.

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

3.7 STARTING AND ADJUSTING

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

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

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

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

3.8 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.9 CORRECTION OF THE WORK

OO. Repair or remove and replace defective construction. Restore damaged substrates and

finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

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

PRODUCT DATA SHEET 42 - Restore permanent facilities used during construction to their specified condition.

PRODUCT DATA SHEET 43 - Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

PRODUCT DATA SHEET 44 - Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

PRODUCT DATA SHEET 45 - Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

SECTION 01731 - CUTTING AND PATCHING February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.
3. 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.
   1. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

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

B. Operational Elements: Do not cut and patch 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, including but not limited to the following:
   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. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

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

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

C. 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.
1.

PART 3 - EXECUTION

3.1 EXAMINATION

D. 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

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

F. 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.

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

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

3.3 PERFORMANCE

I. 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.

J. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

PRODUCT DATA SHEET 11 - 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.

1.4 Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

1.5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.
   2. Repair procedures for selective demolition operations.

B. Related Sections include the following:
   1. Division 1 Section "Summary" for use of the premises and phasing requirements.
   2. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
   3. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
   4. 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. 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.

1.5 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Locations of temporary partitions and means of egress.
   6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

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

E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

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

1.6 QUALITY ASSURANCE

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

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

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. 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.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

G. 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.

H. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

I. Verify that utilities have been disconnected and capped.

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

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

L. 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.

M. 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.

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

3.2 UTILITY SERVICES

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

P. 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.

Q. 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. 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.
   3. 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.

R. 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

S. 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.

T. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

U. 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.

V. 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.

W. 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.

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

Y. Temporary Shoring: Provide and maintain 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

Z. 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.

AA. 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.

BB. 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

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

DD. Existing Facilities: Comply with Owner=s requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

EE. 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.

FF. 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.

GG. 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.

HH. 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.

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

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

KK. 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.

LL. 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.

MM. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 PATCHING AND REPAIRS

NN. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

OO. 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.

PP. Finishes: Restore exposed finishes of patched areas and extend restoration into

adjoining construction in a manner that eliminates evidence of patching and refinishing.

QQ. 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.

1.1 Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1.2 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.

1.3 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

RR. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

PRODUCT DATA SHEET 45 - General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

PRODUCT DATA SHEET 46 - Burning: Do not burn demolished materials.

PRODUCT DATA SHEET 47 - Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 01732

SECTION 01770 - CLOSEOUT PROCEDURES February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
   3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   5. Division 1 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   6. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

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

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

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.

1.6 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. 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 (215-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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

F. 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.

1.1 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, elevator 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.

PRODUCT DATA SHEET 7 - Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

PRODUCT DATA SHEET 8 - Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Record Submittals as requested by the Owner.

B. Related Sections include the following:
   1. Division 1 Section "Closeout Procedures" for general closeout procedures.
   2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   Number of Copies: Submit one set of marked-up Record

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

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

D. Record Shop Drawings: Provide copies of shop drawings or other submittals as requested by the Owner.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

E. Record Prints: Maintain one set of white prints of the Contract Drawings and Shop Drawings.

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1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   A. Dimensional changes to Drawings.
   B. Revisions to details shown on Drawings.
   C. Depths of foundations below first floor.
   D. Locations and depths of underground utilities.
   E. Revisions to routing of piping and conduits.
   F. Revisions to electrical circuitry.
   G. Actual equipment locations.
   H. Duct size and routing.
   I. Locations of concealed internal utilities.
   J. Changes made by Change Order or Construction Change Directive.
   K. Changes made following Architect's written orders.
   L. Details not on the original Contract Drawings.
   M. Field records for variable and concealed conditions.
   N. Record information on the Work that is shown only schematically.

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

Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

F. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Note related Change Orders, Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

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

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

PRODUCT DATA SHEET 9 - Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

PRODUCT DATA SHEET 10 - Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Owner=s reference during normal working hours.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

B. Related Sections include the following:
   1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

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

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

1.4 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 2 of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

B. Organization: Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

C. List of Systems and Subsystems: List systems alphabetically. Include references to

operation and maintenance manuals that contain information about each system.

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

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

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

2.2 MANUALS, GENERAL

G. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

H. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

I. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

J. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness

necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

A. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

B. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

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

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

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

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

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

N. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

O. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

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

Q. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.5 PRODUCT MAINTENANCE MANUAL

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

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

V. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

W. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

Y. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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

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

BB. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

CC. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

DD. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

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

GG. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

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

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

KK. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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

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

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

1.1 Do not use original Project Record Documents as part of operation and maintenance manuals.

1.2 Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

PRODUCT DATA SHEET 40 - Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 01820 - DEMONSTRATION AND TRAINING February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training videotapes.

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

C. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 SUBMITTALS

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

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

B. Qualification Data: For firms and persons specified in AQuality 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. Attendance Record: For each training module, submit list of participants and length of instruction time.

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

E. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Architect and Construction Manager.
      d. Name of Contractor.
      e. Date videotape was recorded.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
   2. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.4 QUALITY ASSURANCE

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

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to

avoid delays.

3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

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

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

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

D. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors and automatic entrance doors.
2. Equipment, including projection screens, loading dock equipment, food-service equipment, and residential appliances.
3. Fire-protection systems, including fire alarm and fire-extinguishing systems.
4. Intrusion detection systems.
5. Conveying systems, including elevators and wheelchair lifts.
6. Heat generation, including boilers, feedwater equipment, pumps and water distribution piping.
7. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
8. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.

9. HVAC instrumentation and controls.
10. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
11. Packaged engine generators, including transfer switches.
12. Lighting equipment and controls.
13. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.

E. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Operating standards.
   c. Regulatory requirements.
   d. Equipment function.
   e. Operating characteristics.
   f. Limiting conditions.
   g. Performance curves.
2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:

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

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   A. Diagnosis instructions.
   B. Repair instructions.
   C. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   D. Instructions for identifying parts and components.
   E. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

F. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

G. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

H. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

I. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least 14 days' advance notice.

J. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

K. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

L. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1.1 At beginning of each training module, record each chart containing learning objective and lesson outline.

PRODUCT DATA SHEET 13 - Videotape Format: Provide high-quality VHS color videotape in full-size cassettes.

PRODUCT DATA SHEET 14 - Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

PRODUCT DATA SHEET 15 - Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01820

DIVISION 2 - SITE WORK

Not Used

DIVISION 3 - CONCRETE

Section 03300 Cast-in-Place Concrete

SECTION 03300 B CAST-IN-PLACE CONCRETE February 6, 2006

PART 1 B GENERAL

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.

2) SUMMARY

a) This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

b) Cast-in-place concrete includes the following:
   i) Foundations and footings.
   ii) Slabs-on-grade.
   iii) Walls, columns, and beams.
   iv) Interior utility equipment pads and bases.

c) Related Sections: The following Sections contain requirements that relate to this Section:
   i) Division 2 Section "Portland Cement Concrete Paving" for concrete paving and walks will be bid in a future bid package.

3) SUBMITTALS

a) General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

b) Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, and others as requested by Architect.

c) Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
   i) Include shop drawings for all walls indicating locations for all rustication lines. Indicate that all joints in the plywood forms occur at these rustication lines.

d) Laboratory test reports for concrete materials and mix design test.

e) Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

4) QUALITY ASSURANCE

a) Codes and Standards: Comply with provisions of the most current version of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   i) ACI 301 "Specifications for Structural Concrete for Buildings".
   ii) ACI 305 AHot Weather Concreting.@
   iii) ACI 306.1 AStandard Specification for Cold Weather Concreting.@
   iv) ACI 311 "Recommended Practice For Concrete Inspection".
   v) ACI 315 "Manual Of Standard Practice For Detailing Concrete Reinforcement".
   vi) ACI 318 "Building Code Requirements for Reinforced Concrete".
   vii) ACI 347 "Recommended Practice For Concrete Formwork".
   viii) Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

b) Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.
   i) Field Quality Control: The Owner will engage a testing laboratory to perform quality control testing during construction.
   ii) Materials and installed work may require testing and retesting at any time during progress of Work. Retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

1) FORM MATERIALS

a) Forms for Exposed Finish Concrete: Forms shall have sufficient wall thickness and or bracing to resist wet concrete loads without deformation.

b) Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

c) Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

2) REINFORCING MATERIALS

a) Reinforcing Bars: ASTM A 615, Grade 60, deformed, except use ASTM A706, grade 60 as noted on drawings.

b) Steel Wire: ASTM A 82, plain, cold-drawn steel.

c) Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
   i) For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

ii) For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

d) Welded-Wire Fabric: ASTM A185

3) CONCRETE MATERIALS

a) Portland Cement: ASTM C 150, Type I/II (Low Alkali)

b) Fly Ash: ASTM C618, Type F, except maximum loss on ignition is limited to 1% with maximum variation of 0.5%.

c) Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
   i) For exposed exterior surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

d) Water: Potable.

e) Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

f) Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures and containing no calcium chloride.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Air-Mix or Perma-Air, Euclid Chemical Co.
      (2) Darex AEA or Daravair, W.R. Grace & Co.
      (3) MB-VR or Micro-Air, Master Builders, Inc.
      (4) Sealtight AEA, W.R. Meadows, Inc.
      (5) Sika AER, Sika Corp.

g) Water-Reducing Admixture: ASTM C 494, Type A.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Eucon WR-75, Euclid Chemical Co.
      (2) WRDA, W.R. Grace & Co.
      (3) Pozzolith Normal or Polyheed, Master Builders, Inc.
      (4) Plastocrete 161, Sika Corp.

h) High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Super P, Anti-Hydro Co., Inc.
      (2) Eucon 37, Euclid Chemical Co.
      (3) WRDA 19 or Daracem, W.R. Grace & Co.
      (4) Rheobuild or Polyheed, Master Builders, Inc.
      (5) Sikament 300, Sika Corp.

i) Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Accelguard 80, Euclid Chemical Co.
      (2) Polarset, W.R. Grace & Co.
      (3) Pozzutec 20, Master Builders, Inc.

j) Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Eucon Retarder 75, Euclid Chemical Co.
      (2) Daratard-17, W.R. Grace & Co.
      (3) Pozzolith R, Master Builders, Inc.
      (4) Plastiment, Sika Corporation.

4) RELATED MATERIALS

a) Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Eucobar, Euclid Chemical Co.
      (2) E-Con, L&M Construction Chemicals, Inc.
      (3) Confilm, Master Builders, Inc.

b) Bonding Agent: Acrylic or Styrene Butadiene base.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) "J-40 Bonding Agent"; Dayton Superior Corp.
      (2) "Everbond"; L & M Construction Chemicals.
      (3) "Hornweld"; A.C. Horn, Inc.
      (4) "Sonocrete"; Sonneborn-Rexnord.
      (5) "Acrylic Bondcrete"; The Burke Co.
      (6) "SBR Latex"; Euclid Chemical Co.
      (7) "Daraweld C"; W.R. Grace
      (8) "Proweld Acrylic"; Prokrete Industries

c) Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements. Provide pressure injectable type where conditions require same.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Euco Epoxy System #452 or #620, Euclid Chemical Co.
      (2) Concresive Standard Liquid, Master Builders, Inc.
      (3) Rezi-Weld 1000, W.R. Meadows, Inc.
      (4) Epcon System Ceramic 6 Epoxy, ITW Redhead/Ramset.
      (5) Sikadur 32 Hi-Mod, Sika Corp.

d) Mortar Patching Material: Prepackaged material suitable for use on dry or damp surfaces.
   i) Products: Subject to compliance with requirements, provide one of the following:
      (1) Emaco R350, Master Builders, Inc.
      (2) SikaRepair 223, Sika Corp.

5) PROPORTIONING AND DESIGNING MIXES

a) Prepare design mixes for each type and strength of concrete by laboratory trial batch method as specified in ACI 301. Use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
   i) Do not use the same testing agency as that used for field quality control testing.

b) Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

c) Design mixes to provide concrete with the following properties as indicated on drawings:
   i) Water-cement ratio = water/(cement + fly ash).
   ii) Normal weight concrete shall have a total weight of between 145 and 155 lbs. per cu.ft.
   iii) Light Weight concrete shall have a total dry weight not exceeding 110 lbs. per cu. ft.
   iv) 4000 psi, 28-day compressive strength; water-cement ratio, 0.45 maximum.
   v) 3000 psi, 28-day compressive strength; water-cement ratio, 0.50 maximum.

d) Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows
   i) Ramps, slabs, and sloping surfaces: Not more than 3 inches (75 mm).
   ii) Reinforced foundation systems and all site walls: Not less than 1 inch (25 mm) and not more than 4 inches (100 mm).
   iii) Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.
   iv) Other concrete: Not more than 4 inches (100 mm).

e) Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

f) Concrete mixes shall be proportioned to minimize drying shrinkage. Use the largest coarse aggregate size practical and proportion mix designs to minimize total water content.

6) ADMIXTURES

a) Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

b) Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

c) High-range water-reducing admixture may be used in concrete with water-cement ratios below 0.50.

d) Use air-entraining admixture where indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
   i) Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
      (1) 6.0 percent for 1 inch (25 mm) maximum aggregate.
      (2) 6.5 percent for 3/4 inch (19 mm) maximum aggregate.

ii) Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

e) Use of additional specified admixtures for water-reducing and set-control is at Contractor's option, at no additional expense to Owner, subject to Architect's approval prior to inclusion in mix designs. Use approved admixtures in strict compliance with manufacturer's directions.

7) CONCRETE MIXING

a) Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

i) Materials handling, batching, and mixing shall conform to applicable provisions of ASTM C 94, except delete references to allowing additional water to be added to material with insufficient slump.

ii) When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

iii) Furnish delivery tickets with each load of concrete delivered to site. In addition to the requirements of ASTM C 94 Section 16.1, provide the following information on delivery tickets:

(1) Date and time of dispatch.

(2) Proportions of all materials used.

(3) Approximate location of final deposit in structure.

(4) Scale weight of load.

PART 3 - EXECUTION

1) GENERAL

a) Coordinate the installation of joint materials with placement of forms and reinforcing steel.

2) FORMS

a) General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

i) Provide Class A tolerances for concrete surfaces exposed to view.

ii) All footing shall be formed.

b) Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste. Coordinate with structural steel supplier for placement of embedded steel items and bolts.

c) Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

d) Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

e) Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

f) Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3) PLACING REINFORCEMENT

a) General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

b) Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

c) Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

d) Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

e) Splice reinforcing bars in accordance with ACI 318. Splice only where required or permitted by drawings, or where authorized by Architect.

4) JOINTS

a) Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect. Refer to Section 03331.

b) Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

c) Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

d) Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

e) Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
   i) Use 15 lb. building paper for isolation joints.

f) Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/4 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.
   i) Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
   ii) Contraction joints may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
   iii) If joint pattern is not shown, provide joints not exceeding 10 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
   iv) Joint sealants material is specified in Division 7 Sections of these specifications.

5) INSTALLING EMBEDDED ITEMS

a) General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

b) Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

6) PREPARATION OF FORM SURFACES

a) General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

b) Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

c) Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

7) CONCRETE PLACEMENT

a) Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work cooperate with such trades in setting such work.

b) General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

c) Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

d) Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
   i) Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
   ii) Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

e) Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placement of a panel or section is completed.
   i) Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
   ii) Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
   iii) Maintain reinforcing in proper position during concrete placement.

f) Cold-Weather Placement: Comply with provisions of ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   i) When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 55 deg F and not more than 75 deg F at point of placement.
   ii) Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   iii) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

g) Hot-Weather Placement: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified. Hot weather is defined as air temperature exceeding 90 deg F (32 deg

C), or any combination of temperature, humidity and wind velocity which causes a rate of evaporation in excess of 0.2 pounds per square foot per hour as determined by ACI C 305R figure 2.1.5.

i) Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

ii) Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

iii) Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

iv) Use water-reducing retarding admixture (type D) when required by high temperatures, low humidity, or other adverse placing conditions.

8) FINISH OF FORMED SURFACES

a) Rough Form Finish: Formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

b) Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

i) Smooth Rubbed Finish: Provide smooth rubbed finish to concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.

(1) Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

c) Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

9) MONOLITHIC SLAB FINISHES

a) General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

b) Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

i) After placing slabs, plane surface to tolerances for floor flatness (F) of 15 and floor levelness (F) of 13. Slope surfaces uniformly to drains where required.

After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

c) Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

i) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both, Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F 18 - F 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

d) Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

i) After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 20 - F 17. Grind smooth surface defects which would telegraph through applied floor covering system.

e) Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

f) Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

i) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

10) MISCELLANEOUS CONCRETE ITEMS

a) Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

11) CONCRETE CURING AND PROTECTION

a) General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

i) Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

ii) Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

b) Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

i) Provide moisture curing by following methods.

(1) Keep concrete surface continuously wet by covering with water.

(2) Continuous water-fog spray.

(3) Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

ii) Provide moisture-cover curing as follows:

(1) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

iii) Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

(1) Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

(2) Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

iv) Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

v) Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

vi) Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

vii) Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

12) REMOVAL OF FORMS

a) General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

b) Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members, at Contractor's expense.

c) Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports. Apply curing to formed surfaces upon removal of forms and continue curing.

13) REUSE OF FORMS

a) Re-Used of Forms:
   i) Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
   ii) When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

14) CONCRETE SURFACE REPAIRS

a) Patching Defective Areas: Repair and patch defective areas with repair mortar immediately after removing forms, when acceptable to Architect. Refer to Section 03331 for specific requirements.

b) Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

15) QUALITY CONTROL TESTING DURING CONSTRUCTION

a) General: The Owner will employ a testing agency to perform tests and to submit test reports.

b) Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.
   i) Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
      (1) Slump: ASTM C 143; one test at point of discharge for every third load. Also verify initial slump when HRWR (superplasticizer) is used.
      (2) Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each set of compressive strength test specimens.
      (3) Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
      (4) Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders (plus additional cylinders as required by contractor for post-tensioned concrete) for each compressive-strength test, unless

otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

(5) Compressive-Strength Tests: ASTM C 39; one set for each 50 cubic yards, or fraction thereof, of each concrete class placed in any one day,or for each 5000 sq. ft. of surface area placed; one specimens tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

(6) Slump, air and temperature of concrete used for suspended slabs at parking garage, including exhibition suspended floor slab, shall be tested at point of discharge for every load.

(7) All steel elements shall be fabricated on premises of a fabricator registered and approved by the building officials per section 1701.7 of the U.B.C.

ii) When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

iii) When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

c) Test results will be reported in writing to Architect and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

d) Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03300

DIVISION 4 - MASONRY

Not Used

DIVISION 5 - METALS

Section 05120	Structural Steel
Section 05210	Steel Joists
Section 05310	Steel Deck
Section 05811	Architectural Joint Systems

SECTION 05120 - STRUCTURAL STEEL February 6, 2006

PART 1) - GENERAL

a) SUMMARY

i) Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

ii) Related Sections:
(1) Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
(2) Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

iii) Definitions: Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

b) SUBMITTALS

i) Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
(1) High-strength bolts (each type), including nuts and washers.
(2) Structural steel primer paint.
(3) Shrinkage-resistant grout.

ii) Shop Drawings: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
(1) Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
(a) Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.

iii) Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

iv) Surveys: Submit certified copies of each survey conducted by a registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

c) QUALITY ASSURANCE

i) Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

(1) Promptly remove and replace materials or fabricated components which do not comply.

ii) Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

(1) Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:

(a) Category: Category Cbd, complex steel building structures.

(2) Fabricators without AISC Certification shall provide special inspectors and conduct special inspections as required by Authorities having jurisdication.

(3) Other Certifications, other than AISC, may be acceptable but must be submitted and approved by Authorities having jurisdication prior to fabrication of any steel.

iii) Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

iv) Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

v) Codes and Standards:

(1) Comply with provisions of following, except as otherwise indicated:

(a) AISC "Code of Standard Practice for Steel Buildings and Bridges", AISC "Code of Standard Practice for Steel Buildings and Bridges", excluding the following: Section 1.5.1, Section 3.3 (first sentence and last sentence), Section 3.4, Section 4.2, Section 4.2.1, Section 4.2.2, Section 6.3.2, Section 7.5.4, and Section 7.11.5.

(2) AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.

(3) AISC "Specifications for Architecturally Exposed Structural Steel".

(4) AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

(5) American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".

(6) ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

vi) Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

(1) Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within the last 12 months.

(2) If recertification of welders is required, retesting will be Contractor's responsibility.

d) DELIVERY, STORAGE AND HANDLING

i) Deliver materials to site at such intervals to ensure uninterrupted progress of work.

(1) Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

ii) Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
(1) Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2) - PRODUCTS

a) MANUFACTURER

i) Approved Manufacturers: Subject to compliance with requirements, provide one of the following:
(1) Non-shrink Non-metallic Grout.
(a) Euco N.S.; Euclid Chemical Co.
(b) Masterflow 713; Master Builders
(c) Five Star Grout; U.S. Grout Corp.

b) MATERIALS

i) Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

ii) Wide Flange Structural Steel Shapes: ASTM A 572, Grade 50 enhanced.
(1) Other Structural Steel Shapes, Plates and Bars: ASTM A 36.

iii) Cold-Formed Steel Tubing: ASTM A 500, Grade B.

iv) Hot-Formed Steel Tubing: ASTM A 501.
(1) Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
(a) Finish: Black, except where indicated to be galvanized.

v) Steel Castings: ASTM A 27, Grade 65-35, medium-strength carbon steel.

vi) Anchor Bolts: ASTM A 307, headed type unless otherwise indicated.

vii) Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
(1) Provide hexagonal heads and nuts for all connections.
(2) Provide either hexagonal or square, heads and nuts, except use only hexagonal units for exposed connections.

viii) High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
(1) Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
(2) Direct tension indicator washers may be used at Contractor's option.

ix) Electrodes for Welding: Comply with AWS Code.

x) Structural Steel Primer Paint: SSPC - Paint 13.

xi) Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

xii) Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.

c) FABRICATION

i) Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

(1) Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

(2) Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

ii) Connections: Weld or bolt shop connections, as indicated.

(1) Bolt field connections, except where welded connections or other connections are indicated.

(2) Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

(3) Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

iii) High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

iv) Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

(1) Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

v) Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Where possible shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

d) SHOP PAINTING

i) General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

ii) Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

iii) Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

iv) Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
(1) SP-1 "Solvent Cleaning".
(2) At all exposed exterior steel and exposed interior steel prepare surface in accordance with commercial blast cleaning SSPC-SP6 with median surface profile of 1.5 to 2.0 mils.

v) Painting: Provide a one-coat shop applied paint system complying with Steel Structures Painting Council (SSPC)-Paint System Guide No. 7.00. Refer to Section 09900, Painting, for specific primer required on identified steel items.

PART 3) - EXECUTION

a) PREPARATION

i) Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

b) ERECTION

i) Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Do not shore cambered steel beams unless otherwise indicated on drawings.
(1) Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

ii) Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
(1) Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

iii) Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing

plate prior to packing with grout. Install high strength washers under nuts at all anchor bolts.

iv) Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
(1) Comply with manufacturer's instructions.

v) Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
(1) Level and plumb individual members of structure within specified AISC tolerances.
(2) Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
(3) Splice members only where indicated and accepted on shop drawings.

vi) Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

vii) Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
(1) Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

viii) Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

ix) Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
(1) Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

c) QUALITY CONTROL

i) Testing Agency: Owner will employ and pay a qualified independent testing agency to perform field quality-control testing services specified in this section.

ii) Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

iii) Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

iv) Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

v) Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

vi) Shop Bolted Connections: Inspect or test in accordance with AISC specifications.

vii) Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
- (1) Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- (2) Perform visual inspection of all welds.
- (3) Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.
  - (a) Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
  - (b) Ultrasonic Inspection: ASTM E 164.
- (4) Inspection of shop welding is not required if the fabricator complies with Section 1704.2.2 of the 2003 IBC.

viii) Field Bolted Connections: Inspect in accordance with 2003 IBC Section 1704.3.3.

ix) Field Welding: Inspect and test during erection of structural steel as follows:
- (1) Comply with 2003 IBC Section 1704.3 and Table 1704.3.
- (2) Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- (3) Perform visual inspection of all welds.
- (4) Perform tests of welds as follows:
  - (a) Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
  - (b) Ultrasonic Inspection: ASTM E 164.

d) CLEANUP

i) Refer to Section 01700.

END OF SECTION 05120

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. K-series steel joists.
   2. Joist accessories.

B. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
   2. Division 4 Section "Unit Masonry Assemblies" for installing bearing plates in unit masonry.

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:
   1. Roof Joists: Vertical deflection of 1/360 of the span.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
   1. Indicate locations and details of bearing plates to be embedded in other construction.
   2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

C. Welding certificates.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

F. Research/Evaluation Reports: For joists.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
   1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

B. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

C. Steel Bearing Plates: ASTM A 36/A 36M.

D. 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.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

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1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

G. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

H. Manufacture steel joists of type indicated 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.
1. Joist Type: K-series steel joists.

I. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

J. Provide holes in chord members for connecting and securing other construction to joists.

K. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

L. Camber joists according to SJI's "Specifications." and as indicated.

M. 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

N. 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. Furnish additional erection bridging if required for stability.

O. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

P. 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.

Q. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

R. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

S. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

T. Apply 1 coat of shop 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.

PART 3 - EXECUTION

3.1 EXAMINATION

U. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

V. Do not install joists until supporting construction is in place and secured.

W. 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.

X. Field weld joists to supporting steel bearing plates and framework. 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.

Y. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

Z. 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

AA. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

BB. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:
1. Radiographic Testing: ASTM E 94.
2. Magnetic Particle Inspection: ASTM E 709.
3. Ultrasonic Testing: ASTM E 164.
4. Liquid Penetrant Inspection: ASTM E 165.

CC. Bolted connections will be visually inspected.

DD. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

EE. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

FF. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

GG. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1.1 Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.

1.2 Apply a compatible primer of same type as shop primer used on adjacent surfaces.

PRODUCT DATA SHEET 34 - Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 05310 - STEEL DECK February 6, 2006

PART 1) - GENERAL

a) RELATED DOCUMENTS

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

b) SUMMARY

i) This Section includes the following:
(1) Roof deck.

ii) Related Sections include the following:
(1) Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

c) SUBMITTALS

i) Product Data: For each type of deck, accessory, and product indicated.

ii) Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

iii) Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

iv) Welding Certificates: Copies of certificates for welding procedures and personnel.

v) 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) Mechanical fasteners.

d) QUALITY ASSURANCE

i) 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.

ii) Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

iii) Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.
(1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

(2) Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

iv) AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

v) 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.

e) DELIVERY, STORAGE, AND HANDLING

i) Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

ii) Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2) - PRODUCTS

a) MANUFACTURERS

i) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
(1) Steel Deck:
(a) BHP Steel Building Products USA Inc.
(b) Consolidated Systems, Inc.
(c) Nucor Corp.; Vulcraft Div.
(d) Roof Deck, Inc.
(e) United Steel Deck, Inc.
(f) Verco Manufacturing Co.
(g) Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

b) ROOF DECK

i) 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 B.
(3) Profile Depth: 1-1/2 inches and as scheduled.
(4) Design Uncoated-Steel Thickness: Per plan.
(5) Span Condition: Triple span or more as indicated.
(6) Side Laps: Overlapped or interlocking seam at Contractor's option.

c) ACCESSORIES

i) General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

ii) Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

iii) Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.

iv) Rib Closure Strips: Vulcanized, closed-cell, synthetic rubber.

v) Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

vi) Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

vii) Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2- inch (38-mm) minimum depth. For drains, cut holes in the field.

viii) Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

ix) Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3) - EXECUTION

a) EXAMINATION

i) Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

b) INSTALLATION, GENERAL

i) 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.

ii) Install temporary shoring before placing deck panels, if required to meet deflection limitations.

iii) Locate decking bundles to prevent overloading of supporting members.

iv) 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.

(1) Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.

v) Place deck panels flat and square and fasten to supporting frame without warp or deflection.

vi) Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

vii) Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

viii) Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

ix) Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

c) ROOF DECK INSTALLATION

i) 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 at locations and spacings as indicated on the drawings.

ii) Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on the drawings.

iii) End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
(1) End Joints: Lapped 2 inches (51 mm) minimum.

iv) 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.

v) 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.

vi) 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.

d) FIELD QUALITY CONTROL

i) Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

ii) Field welds will be subject to inspection.

iii) Testing agency will report test results promptly and in writing to Contractor and Architect.

iv) Remove and replace work that does not comply with specified requirements.

v) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

e) REPAIRS AND PROTECTION

i) Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

ii) Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

(1) Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

iii) Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05811 - ARCHITECTURAL JOINT SYSTEMS February 6, 2006

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. Types of joints for which architectural joint systems are specified include the following:
   1. Exterior wall joints.

B. Related Sections include the following:
   1. Division 7 Section "Sheet Metal Flashing and Trim" for sheet metal roof and wall joint systems.
   2. Division 7 Section "Joint Sealants" for elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.3 DEFINITIONS

A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.

B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.

G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
   1. Exterior Joints: Maintain continuity of weather enclosure.
   2. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
   3. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
   4. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
   5. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
   6. Seismic Joints: Remain in place on exposure to seismic activity (movement).
   7. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

B. Shop Drawings: For each joint system specified, provide the following:
   1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes,

provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each exposed metal and elastomeric material of joint system indicated.
   1. Include similar Samples of material for joints and accessories involving color selection.

D. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per ASTM E 119 and ASTM E 814, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Other manufacturers' systems complying with requirements may be considered. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in Part 2 "Architectural Joint Systems" Article.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those indicated in Part 2 "Architectural Joint Systems" Article.

2.2 MATERIALS

F. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

G. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

H. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

I. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

J. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
   2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
   3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.

K. Architectural Joint System: Metal frames and preformed seals for exterior joints on walls.
   1. Basis-of-Design Product: Watson Bowman Acme, Weatherseam, or a comparable product of one of the following:
      a. Balco Metalines, A Division of Balco, Inc.
      a.
      b. MM Systems Corporation.
      c. Nystrom, Inc.
   2. Maximum Joint Width: As indicated.
   3. Nominal Joint Width: As indicated.
   4. Minimum Joint Width: As indicated.
   5. Movement Capability: As indicated.
   6. Type of Movement Capability: Expansion and contraction.
   7. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
   8. Preformed Seal Material: Manufacturer's standard.
      a. Seal Color: Black.
   9. Exposed Frame Material: Aluminum.
   10. Moisture Barrier: Provide manufacturer's standard unit.
   11. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

2.4 FINISHES, GENERAL

L. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

M. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 ALUMINUM FINISHES

N. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

O. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

P. Prepare substrates according to architectural joint system manufacturer's written instructions.

Q. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

R. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

S. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.

T. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

U. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.

V. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
   1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.

3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
4. Locate wall and ceiling covers in continuous contact with adjacent surfaces.
1.
5. Securely attach in place with required accessories.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

W. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

X. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
1.1 For straight sections, provide preformed seals in continuous lengths.
1.2 Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
1.3 Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
1.4 Seal transitions according to manufacturer's written instructions.

Y. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.

Z. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.

3.3 CLEANING AND PROTECTION

PRODUCT DATA SHEET 27 - Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION 05811

DIVISION 6 - WOOD AND PLASTIC

Not Used

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section 07531	EPDM Membrane Roofing
Section 07920	Joint Sealants

SECTION 07531 - EPDM MEMBRANE ROOFING February 6, 2006

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. Mechanically fastened membrane roofing system.
   2. Roof insulation.

B. Related Sections include the following:
   1. Division 6 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
   2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   3. Division 7 Section "Joint Sealants."
   4. Division 15 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.

C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail Resistance: SH.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns.

C. Samples for Verification: For the following products:
   1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
   3. 12-by-12-inch (300-by-300-mm) square of walkway pads or rolls.
   4. 12-inch (300-mm) length of metal termination bars.
   5. 12-inch (300-mm) length of battens.
   6. Six insulation fasteners of each type, length, and finish.
   7. Six roof cover fasteners of each type, length, and finish.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 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. Manufacturer Qualifications: A qualified manufacturer that has UL listing/FMG approval for membrane roofing system identical to that used for this Project.

C. Source Limitations: Obtain components for membrane roofing system approved by roofing membrane manufacturer.

D. 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. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

F. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 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. Special warranty includes roofing membrane, base flashings, roofing accessories, roof insulation, fasteners, walkway products and other components of membrane roofing system.
   2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty against all leaks, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

C. 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. 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 EPDM ROOFING MEMBRANE

D. EPDM Roofing Membrane: ASTM D 4637, Type II, scrim or fabric internally reinforced uniform, flexible sheet made from EPDM, and as follows:
   1. Available Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products Company.
      c. GenFlex Roofing Systems.
      d. Mule-Hide Products Co., Inc.
      e. Johns Manville International, Inc.
   2. Thickness: 60 mils (1.5 mm), nominal.
   3. Exposed Face Color: Black.

2.3 AUXILIARY MATERIALS

E. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

F. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

G. Bonding Adhesive: Manufacturer's standard bonding adhesive.

H. Seaming Material: Single-component butyl splicing adhesive and splice cleaner.

I. Lap Sealant: Manufacturer's standard single-component sealant.

J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

K. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

L. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, prepunched.

M. 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.

N. Miscellaneous Accessories: Provide 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.

2.4 ROOF INSULATION

O. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
   1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.
   2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

P. Cellulosic-Fiber Board Insulation: For tapered applications, provide ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.

1. Available Manufacturers:
   a. Carlisle SynTec Incorporated.
   b. Celotex Corporation.
   c. Firestone Building Products Company.
   d. GAF Materials Corp.
   e. Georgia-Pacific Corporation.

PRODUCT DATA SHEET 17 - Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. Provide in thickness as required to achieve a completed minimum certified Aaged@ value of R-24, when tested according to LTTR-CAN/ULC-S770.

1. Available Manufacturers:
   a. Atlas Roofing Corporation.
   b. Carlisle SynTec Incorporated.
   c. Firestone Building Products Company.
   d. Johns Manville International, Inc.
   e. RMAX.

R. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.

S. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes as required and where indicated for sloping to drain. Fabricate to slopes indicated.

T. Polyisocyanurate insulation shall be installed in two (2) layers with the total thickness meeting the minimum specified R-Value. Where cellulosic-fiber board tapered insulation, crickets, saddles, tapered edge strips, or other insulation shapes are indicated, the cellulosic-fiber board shall be placed between the layers of polyisocyanurate insulation.

2.5 INSULATION ACCESSORIES

U. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

V. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.6 WALKWAYS

W. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
   1. Equal to: ARoof-Gard Pads@ as manufactured by Humane Manufacturing, LLC.

PART 3 - EXECUTION

3.1 EXAMINATION

X. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Y. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

Z. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

AA. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when

rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

BB. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

CC. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

DD. Install tapered insulation under area of roofing to conform to slopes indicated.

EE. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install 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.

FF. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

GG. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

HH. 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 according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.4 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

II. 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.

JJ. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

KK. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

LL. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

MM. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

NN. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, 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.

1) Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

OO. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

PP. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

QQ. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

RR. Install roofing membrane and auxiliary materials to tie into existing roofing.

3.5 BASE FLASHING INSTALLATION

SS. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

TT. 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.

UU. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

VV. Extend flashings over field sheet and up vertical terminations to comply with manufacturer’s standards.

WW. 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.

XX. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

YY. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

ZZ. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

AAA. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

BBB. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

CCC. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

DDD. Protect membrane roofing system from damage and wear during remainder of

construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

EEE. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

FFF. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

GGG. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner.**>
2. Address: <**Insert address.**>
3. Building Name/Type: <**Insert information.**>
4. Address: <**Insert address.**>
5. Area of Work: <**Insert information.**>
6. Acceptance Date: <**Insert date.**>
7. Warranty Period: <**Insert time.**>
8. Expiration Date: <**Insert date.**>

HHH. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

III. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

JJJ. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   A. lightning;
   B. peak gust wind speed exceeding <**Insert wind speed**> mph (m/sec);
   C. fire;
   D. failure of roofing system substrate, including cracking, settlement,

excessive deflection, deterioration, and decomposition;

E. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;

F. vapor condensation on bottom of roofing; and

G. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

PRODUCT DATA SHEET 63 - IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.

1.1 Authorized Signature: <**Insert signature.**>
1.2 Name: <**Insert name.**>
1.3 Title: <**Insert title.**>

END OF SECTION 07531

SECTION 07920 - JOINT SEALANTS February 6, 2006

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 joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry and cast stone units.
      c. Joints between metal panels.
      d. Joints between different materials listed above.
      e. Perimeter joints between materials listed above and frames of doors and windows.
      f. Control and expansion joints in ceilings and other overhead surfaces.
      g. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Tile control and expansion joints.
      c. Joints between different materials listed above.
      d. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of walls and partitions.
      e. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      g. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation joints in cast-in-place concrete slabs.

b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

B. Related Sections include the following:
1. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
2. Division 8 Section "Glazing" for glazing sealants.
3. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
1.
4. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for

compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of nonelastomeric sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

E. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Three years from date of Substantial Completion.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

D. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

F. Elastomeric 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.

G. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

H. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

I. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will

come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

J. Single-Component Neutral-Curing Silicone Sealant:
1. Available Products:
   a. Pecora Corporation; 895.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: Aluminum coated with a high-performance coating.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

K. Single-Component Acid-Curing Silicone Sealant:
1. Available Products:
   a. Dow Corning Corporation; 999-A.
   b. GE Silicones; Construction
   c. Pecora Corporation; 860.
   d. Tremco; Proglaze.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: Aluminum coated with a high-performance coating.

L. Multicomponent Nonsag Urethane Sealant:
1. Available Products:
   a. Pecora Corporation; Dynatrol II.
   b. Tremco; Dymeric 511.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
   a. Use O Joint Substrates: Aluminum coated with a high-performance coating.

M. Multicomponent Pourable Urethane Sealant:
1. Available Products:
   a. Pecora Corporation; Dynatrol II-SG.
   b. Sika Corporation, Inc.; Sikaflex - 2c SL.
   c. Sonneborn, Division of ChemRex Inc.; SL 2.
2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

N. Single-Component Nonsag Urethane Sealant:
1. Available Products:
a. Pecora Corporation; Dynatrol I-XL.
b. Sika Corporation, Inc.; Sikaflex - 15LM.
c. Tremco; DyMonic.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.4 SOLVENT-RELEASE JOINT SEALANTS

O. Acrylic-Based Solvent-Release Joint Sealant: Comply with ASTM C 1311 or FS TT-S-00230.
1. Available Products:
a. Tremco; Mono 555.

P. Butyl-Rubber-Based Solvent-Release Joint Sealant: Comply with ASTM C 1085.
1. Available Products:
a. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
b. Tremco; Tremco Butyl Sealant.

2.5 LATEX JOINT SEALANTS

Q. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

R. Available Products:
1. Pecora Corporation; AC-20+.
2. Sonneborn, Division of ChemRex Inc.; Sonolac.
3. Tremco; Tremflex 834.

2.6 ACOUSTICAL JOINT SEALANTS

S. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Available Products:
a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.7 JOINT-SEALANT BACKING

T. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

U. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

V. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

W. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

X. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

Y. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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

PART 3 - EXECUTION

3.1 EXAMINATION

AA. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

BB. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

CC. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   A. Metal.
   B. Glass.
   C. Glazed surfaces of ceramic tile.

DD. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

EE. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

FF. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

GG. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

HH. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

II. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

JJ. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

KK. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Seal abutting joint at all dissimilar materials.

LL. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not

discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

MM. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

NN. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so

OO. sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

PP. Joint-Sealant Application: Exterior vertical construction joints in cast-in-place concrete.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

QQ. Joint-Sealant Application: Exterior horizontal nontraffic and traffic isolation and contraction joints in cast-in-place concrete slabs.

1. Joint Sealant: Multicomponent pourable urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

RR. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

SS. Joint-Sealant Application: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

TT. Joint-Sealant Application: Exterior perimeter joints between unit masonry and frames of doors and windows.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

UU. Joint-Sealant Application: Exterior control and expansion joints in ceilings and other overhead surfaces.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

VV. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

WW. Joint-Sealant Application: Interior perimeter joints of exterior openings.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

XX. Joint-Sealant Application: Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
1. Joint Sealant: Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

PRODUCT DATA SHEET 51 - Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
1.1 Joint Sealant: Latex sealant.
1.2 Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 07920

DIVISION 8 - DOORS AND WINDOWS

Section 08411	Aluminum-Framed Entrances and Storefronts
Section 08800	Glazing

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS February 6, 2006

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior and interior aluminum-framed storefronts.
      a. Glazing is retained mechanically with gaskets on four sides.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   2. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 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:
1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

C. 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 (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below to less than 1/16 inch (1.5 mm).

D. Structural-Test Performance: Provide aluminum-framed 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.

E. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

F. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
   a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
   b. Test Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C) .
   c. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration Under Static Pressure: Provide aluminum-framed systems that 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. (300 Pa).

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

J. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

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: For aluminum-framed systems. 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. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Selection: For units with factory-applied color finishes.

D. Welding certificates.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

G. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

H. 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.
Engineering Responsibility: 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 and submission of reports of tests performed on manufacturer's standard assemblies.

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. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ICC/ANSI A117.1.

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed 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 aluminum-framed 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 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. Water leakage through fixed glazing and framing areas.
      e. 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 MANUFACTURERS

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. EFCO Corporation.
   2. Kawneer.

a. Equal to: Kawneer VG 451T.
3. United States Aluminum.
4. Vistawall Architectural Products.

2.2 MATERIALS

D. 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, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

E. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

F. 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.

G. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

H. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

I. 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.

J. 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.

K. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

L. Glazing: As specified in Division 8 Section "Glazing."

M. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

N. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 ACCESSORY MATERIALS

O. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

P. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.6 FABRICATION

Q. Form aluminum shapes before finishing.

R. 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.

S. Framing Members, General: Fabricate components that, when assembled, have the

following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. 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 maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

T. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

U. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

V. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

W. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

X. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

Y. 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

Z. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight, unless otherwise indicated.

AA. 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.

BB. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

CC. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

DD. Install components plumb and true in alignment with established lines and grades, without warp or rack.

EE. Install glazing as specified in Division 8 Section AGlazing.@

FF. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

GG. 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 (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment:

A. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).

B. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

END OF SECTION 08411

SECTION 08800 - GLAZING February 6, 2006

PART 1 -

PART 2 -

PART 3 - PART PART 4 - - GENERAL

4.1 RELATED DOCUMENTS

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

4.2 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. Storefront framing.

4.3 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

4.4 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 thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
   b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads."
   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      1) Load Duration: 60 seconds or less.
   d. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
      1. For monolithic-glass lites heat treated to resist wind loads.
      2. For insulating glass.
   e. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
   f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to

procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- (13-mm-) wide interspace.
3. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
4. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
5. Solar Optical Properties: NFRC 300.

4.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
   1. Insulating glass for each designation indicated.
   2. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

F. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
   1. Insulating glass.
   2. Glazing sealants.
   3. Glazing gaskets.

G. Warranties: Special warranties specified in this Section.

4.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.

C. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
      a. Perform tests under normal environmental conditions replicating those that will exist during installation.
   2. Submit not fewer than nine pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, and insulating units) as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

H. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute.

K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

4.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

4.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

4.9 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for 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 5 -

PART 6 -

PART 7 - PART PART 8 - - PRODUCTS

8.0 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

8.1 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

8.2 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

8.3 INSULATING GLASS

A. Insulating-Glass Units: Preassembled 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 the Insulating-Glass Schedule at the end of Part 3.
   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 "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:
   1. Polyisobutylene and hot-melt butyl.

D. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   1. Aluminum with mill or clear-anodized finish.
   2. Desiccant: Molecular sieve or silica gel, or blend of both.
   3. Corner Construction: Manufacturer's standard corner construction.

8.4 ELASTOMERIC 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: As selected by Architect from manufacturer's full range for this characteristic.

B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
   1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

C. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

8.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: 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 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; 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.

8.6 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

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.

8.7 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 A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. 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.

8.8 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

PART 9 -

PART 10 -

PART 11 - PART PART 12 - - EXECUTION

12.0 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

12.1 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

12.2 GLAZING, GENERAL

A. 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.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass 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.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner

recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

12.3 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. 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.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. 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.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

12.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. 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.

C. 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.

D. Install gaskets so they protrude past face of glazing stops.

12.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

12.6 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

12.7 PROTECTION AND CLEANING

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.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

12.8 MONOLITHIC FLOAT-GLASS SCHEDULE

A. Uncoated Clear Float Glass: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
   1. Uncoated Clear Annealed Float Glass: Annealed or Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with performance requirements.
   2. Uncoated Clear Heat-Strengthened Float Glass: Kind HS (heat strengthened).
   3. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered).

12.9 INSULATING-GLASS SCHEDULE

A. Insulating Glass: Where glass of this designation is indicated, provide uncoated insulating-glass units complying with the following:
   1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm
   2. Interspace Content: Air.
   3. Indoor Lite: Type I (transparent glass, flat), Class 1 (clear) float glass.
      a. Kind HS (heat strengthened), Condition A (uncoated surfaces).
   4. Outdoor Lite: Type I (transparent glass, flat) float glass.
      a. Class 1 (clear).
      b. Kind HS (heat strengthened), Condition A (uncoated surfaces).
   5. Visible Light Transmittance: 79%
   6. Winter Nighttime U-Value: 0.48
   7. Summer Daytime U-Value: 0.55
   8. Solar Heat Gain Coefficient: 0.70

SCHEDULE 10 - GLAZING SEALANT SCHEDULE

PRODUCT DATA SHEET 0 - Low-Modulus Nonacid-Curing Silicone Glazing Sealant: Where glazing sealants of this designation are indicated, provide products complying with the following:

1. Products: Available products include the following:
   a. 790; Dow Corning.
   b. UltraPruf SCS2300; GE Silicones.
   c. Spectrem 1; Tremco.

12.2 Type and Grade: S (single component) and NS (nonsag).

12.3 Class: 25.

12.4 Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.

12.5 Use Related to Exposure: NT (nontraffic).

12.6 Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

   A. Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.

END OF SECTION 08800

DIVISION 9 - FINISHES

Section 09680	Carpet
Section 09900	Painting

SECTION 09680 - CARPET February 6, 2006

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 floor carpet and carpet accessories as shown on the drawings and specified herein.

B. General Contractor is directed to purchase and coordinate the installation of carpet through the State-wide contract with Midwest Office Supply, the State Carpet Contractor.

C. Pre-determined prices for carpet, including installation, are available for State-owned facilities. Any recent modifications to the State-wide contract prices are to be itemized.

D. Architect will coordinate with the State Carpet Contract to develop colors, patterns, locations, special layouts, and actual yardage of carpet. This information is to be submitted to the DFCM Project Manager who will order the carpet.

E. Related Sections include the following:
   1. Division 9 Section "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Type, color, and location of insets and borders.
10. Type, color, and location of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet: 12-inch-square Sample.
2. Exposed Edge Stripping and Accessory: 12-inch-long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. 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.

C. 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 carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to 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.

1. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET

B. Approved Product:
   1. Mill: Shaw Contract
      a. Style: Synthesis III SQ
      b. Style Number: 59050
      c. Refer to finish plans for colors, types and patterns.

C. Face System: 100% Solutia Ultron VIP BCF Nylon.

D. Face Construction: Random Tipshear.

E. Gauge: 1/10".

F. Stitches: 11.0

G. Production Yarn Weight: 30.0 ozs/sq.yd.

H. Pile Height Average: .154 inches for finished carpet per ASTM D 418.

I. Density Factor: 7,013 oz/cu.yd.

J. Weight Density: 210,390

K. Dye Method: Yarn Dyed.

L. Backing Structure:
   1. Secondary Backing: PermaBac

M. Size: 18" x 18" Tile

N. Performance Characteristics: As follows:
   1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
   2. Dry Breaking Strength: Not less than 100 lbf per ASTM D 2646.
   3. Resistance to Insects: Comply with AATCC-24.
   4. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
   5. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
   6. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.

2.2 INSTALLATION ACCESSORIES (By State Carpet Contract)

O. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:
   1. Carpet manufacturer.

P. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:
   1. Carpet manufacturer.

Q. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

R. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

S. Rubber Accessory Molding: Provide rubber accessory molding complying with the following:
   1. Color: As selected by Architect from manufacturer's full range of colors produced for rubber accessory molding complying with requirements indicated.
   2. Product Description: Including but not limited to carpet edge for glue-down applications, carpet nosing, tile and carpet joiner.
   3. Profile and Dimensions: As indicated and as required.

PART 3 - EXECUTION

3.1 EXAMINATION (By State Carpet Contract)

T. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

U. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:
      A. Carpet manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

V. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

W. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

X. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

Y. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
   1. Carpet manufacturer.

Z. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION (By State Carpet Contract)

AA. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."

BB. Stair Installation: Comply with CRI 104, Section 12, "Carpet on Stairs."

CC. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
   1. Level adjoining border edges.

DD. Do not bridge building expansion joints with carpet.

EE. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

FF. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

GG. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

HH. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

II. (By State Carpet Contract): Perform the following operations immediately after installing carpet:

1.1 Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.

1.2 Remove yarns that protrude from carpet surface.

1.3 Vacuum carpet using commercial machine with face-beater element.

PRODUCT DATA SHEET 36 - (By General Contractor): Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

PRODUCT DATA SHEET 37 - (By General Contractor): Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09680

SECTION 09900 - PAINTING February 6, 2006

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painting work, interior and exterior. Work Includes, but is not limited to painting the following:
   1. Exterior steel.
   2. Exterior metal mechanical units.
   3. Interior walls and ceilings.
   4. Interior steel rails and misc. metal.
   5. Exterior exposed metal flashing.
   6. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, plug mold, electric panels, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated. Field painting of a roof mounted mechanical units is part of this section.

B. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

C. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint all exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard or custom colors and finishes. Multiple colors may be selected by the Architect for any type of paint system.
   1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
   2. Walls behind scheduled coverings shall receive prime coat.
   3. If it can be seen, paint it.

D. Following categories of work are not included as part of field-applied finish work.
   1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, elevator entrance doors and frames, elevator equipment, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.
   2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
   3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
   4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

5. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

C. Related Sections:

1. Shop Primers: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
   a. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.

D. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including Paint label analysis and application instructions for each material proposed for use.

B. Samples: Prior to beginning work, Architect will furnish color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1. On 12" x 12" hardboard, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.
2. On actual wood surfaces, provide two 4" x 8" samples of natural and stained wood finish. Label and identify each as to location and application.
3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface,or as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.
   a. Final acceptance of colors will be from samples applied on the job.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.4 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Name or title of material.
   2. Fed. Spec. number, if applicable.
   3. Manufacturer's stock number and date of manufacture.
   4. Manufacturer's name.
   5. Contents by volume, for major pigment and vehicle constituents.
   6. Thinning instructions.
   7. Application instructions.
   8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
   1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.5 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50°F and 90°F, unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F and 95°F, unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
   1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Determine moisture content of surfaces to be painted by performing appropriate tests using a commercially available moisture meter. Apply paint only when surfaces are within limits specified by the paint manufacturer=s printed instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Approved Manufacturers:
   1. ICI Paint Stores.
   2. PPG Industries, Pittsburgh Paints (Pittsburgh).
   3. Pratt and Lambert (P & L).
   4. The Sherwin-Williams Company (S-W).
   5. Benjamin Moore & Co.
   6. Kwal-Howells Paint.

2.2 MATERIALS

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Proprietary names used to designate color or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.

D. Manufacturer's products which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Architect. Furnish material data and manufacturer's certificate of performance to Architect for any proposed substitutions.

E. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

F. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.
   1. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been correct in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

C. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

D. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

E. Cementitious Materials: Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
   1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
   2. Clean concrete floor surfaces scheduled to be painted with a commercial solution or muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.

F. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
   1. Caulk fabrication joints in hollow metal door frames which paint application cannot bridge.

G. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

H. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

I. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, fry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
   1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
   2. When transparent finish is required, use spar varnish for backpriming.

J. Materials Preparation:
   1. Mix and prepare painting materials in accordance with manufacturer's directions.

2. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
3. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.3 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
2. Provide finish coats which are compatible with prime paints used.
3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
7. Finish doors on tops, bottoms and side edges same as faces, unless otherwise indicated.
8. Sand lightly between each succeeding enamel or varnish coat.
9. Omit first coat (exterior faces of surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firms, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
2. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

C. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed to mechanical equipment rooms and in occupied spaces.
1. Mechanical items to be painted include, but are not limited to, the following:
   a. Piping, pipe hangers, and supports.
   b. Roof mounted mechanical units.
   c. Ductwork, where exposed in occupied spaces.
   e. Motor, mechanical equipment, and supports.
   f. Accessory items.
2. Electrical items to be painted include, but are not limited to, the following:
   a. Conduit and fittings.

D. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
   1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:
   1. Owner will engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
      a. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.
      b. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.5 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
   1. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using car not to scratch or otherwise damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
   1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
   2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

C. Extra Stock: Deliver stock or maintenance materials to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

1. Paint: Furnish not less than one (1) full gallon for each color and type of paint installed.

3.6 EXTERIOR PAINT SCHEDULE

A. General: Provide the following Paint systems for the various substrates, as indicated.

1. METAL (Aluminum)

(1) Latex Systems

(a) Gloss Finish

1st Coat: S-W DTM Acrylic Gloss Coating, B66 Series

2nd Coat: S-W DTM Acrylic Gloss Coating, B66 Series (10 mils wet, 4 mils dry per coat)

2. METAL (Galvanized)

(1) Latex Systems

(a) Gloss Finish

1st Coat: S-W DTM Acrylic Primer, B66W1 Series (10 mils wet, 5 mils dry per coat)

2nd Coat: S-W DTM Acrylic Gloss Coating, B66 Series

3rd Coat: S-W DTM Acrylic Gloss Coating, B66 Series (10 mils wet, 4 mils dry per coat)

3. METAL (Miscellaneous Iron, Ornamental Iron)

(1) Alkyd Systems

(a) Gloss Finish

1st Coat: S-W Kem Kromik Universal Metal Primer, B50Z Series (6 mils wet, 3 mils dry)

2nd Coat: S-W Industrial Enamel, B54Z Series

3rd Coat: S-W Industrial Enamel, B54Z Series (5 mils wet, 2 mils dry per coat)

3.7 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated.

1. METAL - (Galvanized)

a. Latex Systems

(1) Semi-Gloss Finish

1st Coat: S-W DTM Acrylic Primer, B66W1 Series (10 mils wet, 5 mils dry per coat)

2nd Coat: S-W ProMar 200 Latex Semi-Gloss B31W200 Series

3rd Coat: S-W ProMar 200 Latex Semi-Gloss B31W200 Series (4 mils wet, 1.3 mils dry per coat)

2. METAL - (Exposed Structural Steel, Joists, Beams, Misc. & Ornamental Iron, Non-Galvanized Metal)

a. Latex Systems

(1) Semi-Gloss Finish

1st Coat: DTM Acrylic Primer/Finish, B66W1 (6 mils wet, 3 mils dry)

2nd Coat: S-W ProMar 200 Latex Semi-Gloss B31W200 Series

3rd Coat: S-W ProMar 200 Latex Semi-Gloss B31W200 Series (4 mils wet, 1.3 mils dry per coat)

3. DRYWALL (Walls, Ceilings, Gypsum Board, Etc.)

a. Latex Systems

(1) Semi-Gloss Finish

1st Coat: S-W Preprite 200 Latex Wall Primer, B28W200 (4 mils wet, 1.2 mils dry)

2nd Coat: S-W ProMar 200 Latex Semi-Gloss, B31W200 Series

3rd Coat: S-W ProMar 200 Latex Semi-Gloss, B31W200 Series (4 mils wet, 1.3 mils dry per coat)

4. DRYWALL (Behind Scheduled Wall Coverings, Tackable Wall Panels, Casework)

a. Latex Systems

(1) Semi-Gloss Finish

1st Coat: S-W Preprite 200 Latex Wall Primer, B28W200 (4 mils wet, 1.2 mils dry)

5. CONCRETE SLABS (Floors not scheduled for applied finishes)

a. Primer: EPOPRIME WB by L & M Construction Chemicals, Inc. Apply at rate of 400 sq. ft. per gallon.

b. 1st and 2nd Coat: Durathane HS/VOC, Moisture-Cured Polyurethane Sealer by L & M Construction Chemicals, Inc. Apply at rate of 300 sq.ft. per gallon.

END OF SECTION 09900

DIVISION 10 thru DIVISION 14

Not Used

DIVISION 15 - MECHANICAL

Section 15010	Basic Mechanical Requirements
Section 15050	Basic Mechanical Materials and Methods
Section 15055	Motors
Section 15060	Hangers and Supports
Section 15075	Mechanical Identification
Section 15080	Mechanical Insulation
Section 15411	Plumbing Piping
Section 15430	Plumbing Specialties
Section 15815	Metal Ducts
Section 15820	Duct Accessories
Section 15855A	Air Outlets and Inlets
Section 15950	Testing, Adjusting and Balancing; Mechanical O&M Manuals; and Systems Commissioning

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

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 and the other sections of Division 15.

B. This section applies to all Division 15 specification sections.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Rough-ins.
5. Mechanical installations.
6. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 15, plus general related specifications including:
a. Access to mechanical installations.
b. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

1.3 GOVERNING REGULATIONS AND AUTHORITIES

A. Regulations include laws, ordinances, codes, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work, govern the execution of the work embodied in the contract documents, and the interpretation of the contract documents.

B. Applicable codes and documents to this project are, but not limited to, the following:
1. 2003 International Building Code - (with Utah amendments)
2. 2003 International Mechanical Code - (with Utah amendments)
3. 2003 International Plumbing Code - (with Utah amendments)
4. 2003 International Energy Conservation Code.
5. National Electrical Code - current edition

1.4 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS", and as outlined below.

1. By description, catalog number and manufacturer's name standards of quality have been established for certain manufactured equipment items and specialties which are to be furnished by this Division. Substitute products of equal or better quality may only be proposed for use if specifically named in the specifications or given written approval prior to bidding. Requests for substitution shall be made in accordance with the General Provisions.
2. Within 45 days after the date of award of contract, and before commencement of work, a complete schedule of all equipment and materials proposed for installation shall be submitted.
3. Submittal data for Division 15 shall be submitted arranged in a three-ring binder. Binder shall have a complete index with equipment listed in the same sequence as the sections in the specifications. Identify the equipment submitted with drawings, schedule number, and specification paragraph number.
4. Submittals shall include, but not be limited to the following:
   a. Scheduled Equipment Items
   b. Vibration Elimination Devices
   c. Seismic Restraint System
   d. Insulation
   e. Registers, Grilles, and Diffusers
   f. Certificates of Guarantee
5. Description of equipment shall include sizes, capacities, operating characteristics, brand names, accessories, materials gauges, manufacturer's maintenance instructions and other pertinent information required to establish quality of the products. List on the front of catalogs the page number referring to submitted items. Underline applicable data on the indicated pages. Where proposed equipment size varies from equipment first named, Contractor shall specifically call Architect's attention to that fact in writing at the time of submission of data.
6. All submittal data shall be turned over to the Architect at one time. No consideration will be given to partial submittals.
7. After engineering review, the Contractor may proceed to place an order for such item of equipment. However, actual fabrication by manufacturer may not commence until complete and accurate shop drawings have been submitted to Architect and have received his reviewed stamp and signature.
8. A copy of the complete contract specification for the item, including any specific details of construction, shown on the drawings shall be sent to the factory furnishing such item, at the time the order is placed to avoid unnecessary errors.
9. The Contractor should protect himself with the supplier of alternate named equipment. Should Contractor submit on any item of equipment other than first named equipment in the specification and if alternate equipment is rejected or disapproved by the Architect for any of the reasons stated above, the Contractor shall be required to resubmit on first named equipment.
10. All items other than first named specified equipment shall show and state all exceptions and deviations taken and shall include design calculations.
11. The Contractor shall review the submittals prior to submission to make sure that submittals are complete in all details. Contractor shall verify equipment dimensions to fit the spaces provided with sufficient clearance for servicing the equipment. Submittals will not be reviewed which do not bear the Contractor's notation that such checking has been made.
12. Equipment submittal shall show the proper arrangements to suit installation and maintenance such as motor location, access doors, filter removal, piping connections, etc.

13. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.
14. Review and acceptance of submittal does not relieve the Contractor of responsibility for fulfilling the contract requirements. Review of the submittal shall not change the contract requirements. Items not covered in the accepted submittal or items incorrectly covered but not recognized or identified shall not be used contrary to the contract documents.

B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required, which will be retained by the Mechanical Consulting Engineer.
1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
3. Product Data: 1 additional copy of each item.
4. Samples: 1 additional set.

C. Additional copies may be required by individual sections of these Specifications.

1.5 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section "COORDINATION," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
a. Clearances for installing and maintaining insulation.
b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
c. Equipment connections and support details.
d. Exterior wall and foundation penetrations.
e. Fire-rated wall and floor penetrations.
f. Sizes and location of required concrete pads and bases.
g. Valve stem movement.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "CONTRACT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, etc.). Refer to Division 15 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 1 Section "FIELD ENGINEERING" to record the locations and invert elevations of underground installations.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.8 WARRANTIES

A. In addition to guarantee specified in General Conditions, guarantee heating and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. That the circulation of water shall be complete and even.

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

D. That all devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system.

E. All equipment and the complete system shall be guaranteed for a period of one year from the date of Substantial Completion. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period.

F. Any failure that disables a heating or cooling system shall have repairs completed within 24 hours. If repair parts are not available in local stock, they shall be shipped via air freight at no charge to the owner.

PART 2 - EXECUTION

2.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

2.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with manufacturers installation instructions and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
10. Completely clean all mechanical equipment and systems of dirt, dust, debris and overspray at the time of substantial completion.
11. All factory-authorized equipment start-ups shall be witnessed by the Owner's representative, unless written exception is given. Any equipment start-ups completed without Owner's representative being present shall be repeated.

2.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
   a. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."
2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
   a. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."

END OF SECTION 15010

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This section applies to all Division 15 specification sections.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Flexible connectors.
4. Mechanical sleeve seals.
5. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
6. Installation requirements common to equipment specification sections.
7. Mechanical demolition.
8. Cutting and patching.
9. Touchup painting and finishing.
10. Accessibility.

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

1.3 DEFINITIONS

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

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

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

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

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

F. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. NP: Nylon plastic.
   4. PE: Polyethylene plastic.
   5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

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

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

C. Welder Certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.5 COORDINATION DRAWINGS

A. General: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Have coordination drawings available at job site for coordination. Include the following:
   1. Planned piping layout, including valve and specialty locations and valve-stem movement.
   2. Clearances for installing and maintaining insulation.
   3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   4. Equipment and accessory service connections and support details.
   5. Exterior wall and foundation penetrations.
   6. Fire-rated wall and floor penetrations.
   7. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   8. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
   9. Planned duct systems layout, including elbow radii and duct accessories.
   10. Access panel and door locations.

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

1.6 QUALITY ASSURANCE

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

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

C. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code -- Steel."

D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

1.8 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

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

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

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

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

G. Coordinate connection of electrical services.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

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

3. Dielectric-Flange Insulating Kits:
   a. Calpico, Inc.
   b. Central Plastics Co.

4. Dielectric Couplings:
   a. Calpico, Inc.
   b. Lochinvar Corp.

5. Dielectric Nipples:
   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

6. Metal, Flexible Connectors:
   a. ANAMET Industrial, Inc.
   b. Central Sprink, Inc.
   c. Flexicraft Industries.

d. Flex-Weld, Inc.
e. Grinnell Corp.; Grinnell Supply Sales Co.
f. Hyspan Precision Products, Inc.
g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
h. Mercer Rubber Co.
i. Metraflex Co.
j. Proco Products, Inc.
k. Uniflex, Inc.

7. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. All pipe and pipe fittings shall be American made and clearly labeled as such.

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

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

2.3 JOINING MATERIALS

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

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) 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 (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

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

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

E. Solder Filler Metals: ASTM B 32.
   1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
   2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
   3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
   4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
   5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.
   1. BCuP Series: Copper-phosphorus alloys.
   2. BAg1: Silver alloy.

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

H. Solvent Cements: Manufacturer's standard solvent cements for the following:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

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

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

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
   1. Sleeve: ASTM A 126, Class B, gray iron.
   2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

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

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

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

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS (DN50) and Smaller: Threaded.
   2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

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

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

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

2.6 MECHANICAL SLEEVE SEALS

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

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: One piece, with set screw.
      a. Finish: Polished chrome-plate.
   4. Cast Brass: Split casting, with concealed hinge and set screw.

a. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping free of sags and bends.

F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

G. Install piping close to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

H. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

J. Install fittings for changes in direction and branch connections.

K. Install couplings according to manufacturer's written instructions.

L. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

M. Sleeves are not required for core drilled holes.

N. Permanent sleeves are not required for holes formed by PE removable sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
   b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. ABS Piping: ASTM D 2235 and ASTM D 2661.

c. CPVC Piping: ASTM D 2846 and ASTM F 493.
d. PVC Pressure Piping: ASTM D 2672.
e. PVC Nonpressure Piping: ASTM D 2855.
f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
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.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to manufacturers written instructions and approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

G. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors.

3.3 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
   5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.6 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

END OF SECTION 15050

SECTION 15060 - HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:
1. Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation and seismic restraint devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

C. Design seismic restraint hangers and supports for piping and equipment.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Channel Support Systems:
   a. B-Line Systems, Inc.
   b. Grinnell Corp.; Power-Strut Unit.
   c. GS Metals Corp.
   d. Michigan Hanger Co., Inc.; O-Strut Div.
   e. National Pipe Hanger Corp.
   f. Thomas & Betts Corp.
   g. Unistrut Corp.
   h. Wesanco, Inc.

2. Thermal-Hanger Shield Inserts:
   a. Carpenter & Patterson, Inc.
   b. Michigan Hanger Co., Inc.
   c. PHS Industries, Inc.
   d. Pipe Shields, Inc.
   e. Rilco Manufacturing Co., Inc.
   f. Value Engineered Products, Inc.

3. Powder-Actuated Fastener Systems:
   a. Gunnebo Fastening Corp.
   b. Hilti, Inc.
   c. ITW Ramset/Red Head.
   d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Coatings: Galvanized, Metallic.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
1. Coatings: Galvanized, Metallic.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (675 kg).
    c. Heavy (MSS Type 33): 3000 lb (1350 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9.
   2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15075 - MECHANICAL IDENTIFICATION

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.

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices.

1.3 SUBMITTALS

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

B. Product data for identification materials and devices.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Valve Schedules: Submit valve schedules for each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Furnish extra copies (in addition to mounted copies) for Maintenance Manuals.

1.4 QUALITY ASSURANCE

A. Comply with UVSC standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than single type is

specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 (30 mm) inches for ducts and 3/4 (19 mm) inch for access door signs and similar operational instructions.
   1. Material: Fiberboard or brass.
   2. Stencil Paint: Exterior, oil-based alkyd gloss black enamel, except as otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, oil-based alkyd enamel in colors according to ASME A13.1, except as otherwise indicated.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers conforming to ASME A13.1.

D. Pressure-Sensitive Pipe Markers: Manufacturer's standard pre-printed, color-coded, pressure-sensitive vinyl pipe markers, with permanent adhesive conforming to ASME A13.1.

E. Pipes Smaller Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

F. Pipes 6 Inches (150 mm) And Larger: Either full-band or strip-type pipe markers, at least 3 times the letter height and of length required for label.

G. Lettering: Manufacturer's standard pre-printed terms as selected by Architect.

H. Lettering: Use piping system terms as indicated and abbreviate only as necessary for each application length.
   1. Arrows: Either integrally with piping system service lettering (to accommodate both directions), or as separate unit, on each pipe marker to indicate direction of flow.

I. Plastic Duct Markers: Manufacturer's standard laminated plastic, duct markers in the following color code:
   1. Green: Cold air.
   2. Yellow: Hot air.
   3. Yellow/Green: Supply air.
   4. Blue: Exhaust, outside, return, and mixed air.
   5. For hazardous materials exhausts, use colors and designs recommended by ASME A13.1.
   6. Terminology: Include direction of air flow, duct service (supply, return, exhaust, etc.), duct origin (from), duct destination (to), and design cfm.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3-mils thick.
   1. Width: 1-1/2-inches (38 mm) wide on pipes with outside diameters (including insulation) less than 6 inches (150 mm); 2-1/2-inches (65 mm) wide for larger pipes.
   2. Color: Comply with ASME A13.1, except where another color selection is indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch (6 mm) letters for piping system abbreviation and 1/2-inch (13 mm) sequenced numbers. Provide a 5/32-inch (4 mm) hole for fastener.

1. Material: 19-gage polished brass.
2. Material: 0.032-inch-thick (1 mm) aluminum.
3. Material: 19-gage stainless steel.
4. Material: 3/32-inch-thick (2 mm) plastic laminate having 2 black surfaces and a white inner layer.
5. Material: Valve manufacturer's standard solid plastic.
6. Size: 1-1/2-inches (38 mm) diameter, except as otherwise indicated.
7. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass chain (wire link or beaded type) or brass S-hooks.

M. Access Panel Markers: 1/16-inch-thick (1.5 mm) engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3 mm) center hole for attachment.

N. Valve Schedule Frames: Glazed extruded aluminum display frame, with screws for removable mounting on masonry walls for each page of valve schedule.
1. Glazing: ASTM C 1036, 2.5 mm, single thickness, sheet glass.
   a. Type: Type I, flat transparent.
   b. Class: Class 1, clear.
   c. Quality: Glazing B, for general applications.

O. 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 (letter color) melamine subcore, except when other colors are indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraved with engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch (1.5 mm), for units up to 20 square inches (13,000 sq. mm) or 8 inches (200 mm) length; 1/8 inch (3 mm) for larger units.
3. Fasteners: Self-tapping stainless steel screws or contact-type permanent adhesive.

P. Plastic Equipment Markers: Laminated-plastic, in the following color code:
1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of above criteria.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Terminology: Include following, matching schedules as closely as possible:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
8. Size: Approximate 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4-1/2 by 6 inches (115 by 150 mm) for equipment.

Q. Plasticized Tags: Pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing.

1. Size: Approximately 3-1/4 by 5-5/8 inches (80 by 140 mm).
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary wording such as "DANGER," "CAUTION," or "DO NOT OPERATE."

R. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
1. Multiple Systems: Where multiple systems of same name are indicated, identify individual system number as well as service (such as Boiler No. 3, Air Supply No. 1H, or Standpipe F12).

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
1. Stenciled Markers: Complying with ASME A13.1.
2. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
a. Fasten markers on pipes smaller than 6 inches (150 mm) by one of following methods:
1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
2) Adhesive lap joint in pipe marker overlap.
3) Laminated or bonded application of pipe marker to pipe (or insulation).
4) Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch (19 mm) wide, lapped 1-1/2 inches (38 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.
b. Fasten markers on pipes 6 inches (150 mm) and larger by one of following methods:
1) Laminated or bonded application of pipe marker to pipe (or insulation).
2) Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2-inches (38 mm) wide, lapped 3 inches (75 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.
3) Strapped to pipe (or insulation) with manufacturer's standard stainless steel bands.
3. Locate pipe markers and color bands as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
a. Near each valve and control device.
b. Near each branch connection, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
c. Near penetrations through walls, floors, ceilings, or enter non-accessible enclosures.

d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced at a maximum of 50-feet (15 m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic laminate signs or equipment markers on or near each major item of mechanical equipment. Provide signs for following general categories of equipment:
1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gages, thermometers, and similar units.
3. Fuel-burning units including boilers, furnaces, heaters, stills, and absorption units.
4. Pumps, compressors, chillers, condensers, and similar motor- driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
6. Fans, blowers, primary balancing dampers, and mixing boxes.
7. Packaged HVAC central-station and zone-type units.
8. Tanks and pressure vessels.
9. Strainers, filters, humidifiers, water treatment systems, and similar equipment.

C. Optional Sign Types: Stenciled signs may be provided instead of engraved plastic, at Installer's option, where lettering larger than 1-inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
1. Lettering Size: Minimum 1/4 inch (6 mm) for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2 inch (13 mm) for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
2. Terms on Signs: In addition to name of identified unit distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

D. Plasticized Tags: Install within concealed space to reduce amount of text in exposed sign (outside concealment), where equipment to be identified is concealed above acoustical ceiling or similar concealment.
1. Identify operational valves and similar minor equipment items located in unoccupied spaces (including machine rooms) by installing plasticized tags.

E. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing duct system service and direction of flow.
1. Location: In each space where ducts are exposed or concealed by removable ceiling system. Locate signs near points where ducts enter into concealed space and at maximum intervals of 50 feet (15 m).

3.2 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices which have become visually blocked by work of this Division or other Divisions.

B. Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 15075

SECTION 15080 - MECHANICAL INSULATION

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.

1.2 SUMMARY

A. This Section includes pipe, duct, and equipment insulation.

B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.
2. Division 15 Section "Metal Ducts" for duct lining.

1.3 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.

B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 deg F.

D. Thermal Resistivity: "r-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one Btu to flow through one square foot of material, in one hour, at a given mean temperature.

E. Density: Is expressed in lb/sq.ft.

1.4 SUBMITTALS

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

B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

C. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
   1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
   2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.6 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping and duct systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

   1. Glass Fiber:
      a. CertainTeed Corporation.
      b. Knauf Fiberglass GmbH.
      c. Manson.
      d. Owens-Corning Fiberglas Corporation.
      e. John Manville.
      f. USG Interiors, Inc. - Thermafiber Division.

   2. Flexible Elastomeric Cellular:
      a. Armstrong World Industries, Inc.
      b. Halstead Industrial Products.
      c. IMCOA.
      d. Rubatex Corporation.

   3. Calcium Silicate:
      a. Owens-Corning Corporation.
      b. John Manville.

2.2 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.
   1. Thermal Conductivity: 0.26 average maximum, at 75 deg F mean temperature.
   2. Density: 6 pcf average maximum.

D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets.
   1. Thermal Conductivity: 0.32 average maximum, at 75 deg F mean temperature.

E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
   1. Thermal Conductivity: 0.25 average maximum at 75 deg F mean temperature.
   2. Density: 10 pcf average maximum.

F. Adhesive: Produced under the UL Classification and Follow-up service.
   1. Type: Non-flammable, solvent-based.
   2. Service Temperature Range: Minus 20 to 180 deg F.

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
   1. Tubular Materials: ASTM C 534, Type I.
   2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.30 average maximum at 75 deg F.

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.4 CALCIUM SILICATE

A. Material: ASTM C 533, Type I; inorganic, hydrous calcium silicate, non-asbestos fibrous reinforcement; incombustible.

B. Form: Molded flat block, curved block, grooved block, and preformed pipe sections as appropriate for surface.

C. Thermal Conductivity: 0.60 at 500 deg F.

D. Dry Density: 15.0 pcf maximum.

E. Compressive Strength: 60 psi minimum at 5 percent deformation.

F. Fire Performance Characteristics: Provide materials identical to those whose fire performance characteristics have been determined, per test method indicated below, by UL or other testing and inspecting organization acceptable to authorities having jurisdiction.
   1. Test Method: ASTM E 84.
   2. Flame Spread: 0.
   3. Smoke Developed: 0.

2.5 INSULATING CEMENTS

A. Mineral Fiber: ASTM C 195.
   1. Thermal Conductivity: 1.0 average maximum at 500 deg F mean temperature.
   2. Compressive Strength: 10 psi at 5 percent deformation.

B. Expanded or Exfoliated Vermiculite: ASTM C 196.
   1. Thermal Conductivity: 1.10 average maximum at 500 deg F mean temperature.
   2. Compressive Strength: 5 psi at 5 percent deformation.

C. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.
   1. Thermal Conductivity: 1.2 average maximum at 400 deg F mean temperature.
   2. Compressive Strength: 100 psi at 5 percent deformation.

2.6 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:
   1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
   2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.7 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.
   1. Tape Width: 4 inches.
   2. Cloth Standard: MIL-C-20079H, Type I.
   3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:
   1. Stainless Steel: Type 304, 0.020 inch thick.
   2. Galvanized Steel: 0.005 inch thick.
   3. Aluminum: 0.007 inch thick.
   4. Brass: 0.01 inch thick.
   5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

D. Corner Angles: 28-gage, 1-inch by 1-inch aluminum, adhered to 2-inch by 2-inch kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.8 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.
   1. Water Vapor Permeance: 0.08 perm maximum.
   2. Temperature Range: Minus 20 to 180 deg F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.
   1. Water Vapor Permeance: 0.02 perm maximum.
   2. Temperature Range: Minus 50 to 250 deg F.
   3. Color: Aluminum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
   1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
1. Fibrous glass ducts.
2. Metal ducts with duct liner located inside building insulation envelope.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
5. Flexible connectors for ducts and pipes.
6. Vibration control devices.
7. Testing laboratory labels and stamps.
8. Nameplates and data plates.
9. Access panels and doors in air distribution systems.
10. Fire protection piping systems.
11. Sanitary drainage and vent piping, unless indicated otherwise.
12. Drainage piping located in crawl spaces, unless indicated otherwise.
13. Below grade buried piping.
14. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
15. Piping specialties including air chambers, unions, strainers, check valves, plug valves, and flow regulators.
16. Factory insulated equipment.

3.3 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3-inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
   a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.
4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

G. Exterior Wall Penetrations: For penetrations of below grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor barrier coating.

H. Exterior Wall Penetrations: For penetrations of below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.

I. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."

J. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.

K. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.

L. Flanges, Fittings, Valves, and Roof Drain Bowls - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, fittings, and roof drain bowls. Make joints tight. Bond with adhesive.
   1. Use same material and thickness as adjacent pipe insulation.
   2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater.
   3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
   4. Insulate elbows and tees smaller than 3-inches pipe size with premolded insulation.
   5. Insulate elbows and tees 3 inches and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
   6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

M. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 15 Section "Hangers and Supports." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.
   1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.5 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
   1. Miter cut materials to cover soldered elbows and tees.
   2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.6 CALCIUM SILICATE PIPE INSULATION INSTALLATION

A. Secure insulation with stainless-steel bands spaced at 12-inch intervals.

B. Apply 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 16-gage soft-annealed stainless-steel wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

C. Finishing: Apply a skim coat of mineral fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on 1 layer of glass cloth or glass tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth finish.

D. Metal Jacket: Where indicated, apply metal jacket over finished insulation as specified in this Section for installation of metal jackets.

3.7 EQUIPMENT INSULATION INSTALLATION, GENERAL

A. Install board and block materials with a minimum dimension of 12 inches and a maximum dimension of 48 inches.

B. Groove and score insulation materials as required to fit as closely as possible to the equipment and to fit contours of equipment. Stagger end joints.

C. Insulation Thicknesses Greater than 2 Inches: Install insulation in multiple layers with staggered joints.

D. Bevel insulation edges for cylindrical surfaces for tight joint.

E. Secure sections of insulation in place with wire or bands spaced at 9-inch centers, except for flexible elastomeric cellular insulation.

F. Protect exposed corners with corner angles under wires and bands.

G. Removable Insulation: Install insulation on components that require periodic inspecting, cleaning, and repairing for easy removal and replacement without damage to adjacent insulation.

H. Finishing: Except for flexible elastomeric cellular insulation, apply 2 coats of vapor barrier compound to a minimum thickness of 1/16 inch. Install a layer of glass cloth embedded between layers.

3.8 GLASS FIBER EQUIPMENT INSULATION INSTALLATION

A. Secure insulation with anchor pins and speed washers.

B. Space anchors at maximum intervals of 18 inches in both directions and not more than 3 inches from edges and joints.

C. Apply a smoothing coat of insulating and finishing cement to finished insulation.

3.9 FLEXIBLE ELASTOMERIC CELLULAR EQUIPMENT INSULATION INSTALLATION

A. Install sheets of the largest manageable size.

B. Apply full coverage of adhesive to the surfaces of the equipment and to the insulation.

C. Butt insulation joints firmly together and apply adhesive to insulation edges at joints.

3.10 DUCT INSULATION

A. Install block and board insulation as follows:
   1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
   2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:
   1. Smaller Than 24 Inches: Bonding adhesive applied in 6-inch-wide transverse strips on 12-inch centers.
   2. 24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
   3. Overlap joints 3 inches.
   4. Seal joints, breaks, and punctures with vapor barrier compound.

3.11 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch laps at longitudinal joints and 3-inch-wide butt strips at end joints.
   1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

B. Interior Exposed Insulation: Install continuous stainless-steel jackets.

C. Interior Exposed Insulation: Install continuous aluminum jackets.

D. Interior Exposed Insulation: Install continuous PVC jackets.

E. Interior Exposed Insulation: Install continuous glass cloth jackets.

F. Exterior Exposed Insulation: Install continuous aluminum jackets and seal all joints and seams with waterproof sealant.

G. Exterior Exposed Insulation: Install continuous stainless-steel jackets and seal all joints and seams with waterproof sealant.

H. Exterior Exposed Insulation: Install continuous PVC jackets and seal all joints and seams with waterproof sealant.

I. Install metal jacket with 2-inch overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches on center and at butt joints.

J. Install the PVC jacket with 1-inch overlap at longitudinal and butt joints and seal with adhesive.

K. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch overlap at joints. Embed glass cloth between (2) 1/16-inch-thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

3.12 FINISHES

A. Paint finished insulation (except colored PVC jacket) as specified in Division 9 Section "Painting" and with colors according to UVSC standards.

B. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.13 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Interior Piping Systems: Unless otherwise indicated, insulate the following piping systems:
   1. Storm water. Insulate roof drain bodies and all storm water piping.

C. Duct Systems: Unless otherwise indicated, insulate the following unlined duct systems:
   1. Interior exposed unlined supply, combustion, and outside air ductwork.

3.14 PIPE INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:
   1. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel, C - Glass Cloth.
   2. Pipe Sizes: NPS - Nominal Pipe Size.
   3. All system piping shall be thermally insulated in accordance with ASHRAE 90.1-99, table 6.2.4.5.

INTERIOR EXPOSED UNLINED HVAC SUPPLY, COMBUSTION, AND OUTSIDE AIR DUCTS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
GLASS FIBER	BOARD - RECT.	1-1/2	YES	NONE
GLASS FIBER	PIPE - ROUND	1-1/2	YES	NONE

END OF SECTION 15080

SECTION 15411 - PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plumbing piping systems to a point 5 feet outside the building. Systems include the following:
1. Drainage systems, including sanitary and storm.

B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and installation requirements not specified in this Section.
2. Division 15 Section "Plumbing Specialties" for plumbing system components.

1.3 SUBMITTALS

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

B. Product data for the following plumbing piping products:
1. Couplings and fittings for grooved-end steel pipe and grooved-end ferrous fittings.
2. Couplings and fittings for grooved-end copper tube and grooved-end copper fittings.

C. Water samples, test results, and reports specified in "Field Quality Control" and "Cleaning" Articles.

1.4 COORDINATION DRAWINGS

A. Coordination drawings, drawn accurately to scale and coordinating penetrations. Do not submit. Prepare drawings and retain at job site for coordination.

1.5 QUALITY ASSURANCE

A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.

B. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings:
      a. Central Sprink, Inc.
      b. Grinnell Supply Sales Co., Grinnell Corp.
      c. Victaulic Co. of America.
      d. Gruvlok.

   2. Couplings for AWWA-Size, Grooved-End, Ductile-Iron Pipe and Fittings:
      a. Gustin-Bacon Div., Tyler Pipe.
      b. Victaulic Co. of America.

   3. Couplings for Grooved-End Copper Tube and Grooved-End Copper Fittings:
      a. Victaulic Co. of America.
      b. Gruvlok.

2.2 PIPES AND TUBES

A. General: The application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems are indicated in Part 3 Article "Pipe and Fittings Applications."

B. Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn temper.

C. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

D. Copper Drainage Tube: ASTM B 306, Type DWV, drawn temper.

E. Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, seamless, galvanized, plain ends.
   1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless, galvanized, carbon-steel pipe.

F. Ductile-Iron Pipe: AWWA C151, Classes 50 and 51, mechanical joint and push-on joint, with AWWA C104 cement-mortar lining.

G. Flanged Ductile-Iron Pipe: AWWA C115, ductile-iron barrel, Class 150 or 300 iron-alloy threaded flanges, with AWWA C104 cement-mortar lining.

H. Hub and Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service Class.

I. Hubless, Cast-Iron Soil Pipe: CISPI 301 ATSM A-888.

J. Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe: ASTM D 2661, Schedule 40, plain ends.

K. Acrylonitrile-Butadiene-Styrene (ABS) Cellular Core, Plastic Pipe: ASTM F 628, Schedule 40, plain ends.

L. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Tube: ASTM D 2846, SDR 11, plain ends.

M. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.

N. Polybutylene (PB) Plastic Pipe: ASTM D 2662, SIDR11.5 or SIDR9.

O. Polyethylene (PE) Plastic Pipe: ASTM D 2239, SIDR Numbers 9, 7, or 5.3, in combination with PE Compound Number, as required to give pressure rating (PR) not less than 160 psig, plain ends.

P. Polyethylene (PE) Plastic Pipe: AWWA C901, IDR or DR, in combination with PE Compound Number, as required to give pressure rating of 160 psig minimum, plain ends.

Q. Poly(Vinyl Chloride) (PVC) Plastic, Water Pipe: ASTM D 1785; Schedules 40, 80, and 120; plain ends.

R. Poly(Vinyl Chloride) (PVC) Plastic, DWV Pipe: ASTM D 2665, Schedule 40, plain ends.

S. Poly(Vinyl Chloride) (PVC) Cellular Core, Nonpressure, Plastic Pipe: ASTM F 891, Schedule 40, plain ends.

2.3 PIPE FITTINGS AND TUBE FITTINGS

A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.

B. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.

C. Wrought-Copper and Bronze, Grooved-End Fittings: ASTM B 75 Tube and ASTM B 584 Bronze Castings.

D. Copper Tube, Grooved-End Mechanical Fittings: ASTM B 75, copper tube and ASTM B 584 bronze castings.

E. Bronze Flanges: ASME B16.24, Classes 150 and 300.

F. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
   1. Threaded Ends: Threads conforming to ASME B1.20.1.

G. Malleable-Iron Unions: ASME B16.39, Classes 150 and 300, hexagonal stock, with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends having threads conforming to ASME B1.20.1.

H. Galvanized, Cast-Iron Threaded Fittings: ASME B16.4, Classes 125 and 250, standard pattern, with threads conforming to ASME B1.20.1.

I. Galvanized, Cast-Iron Threaded Drainage Fittings: ASME B16.12, recessed drainage pattern, with threads conforming to ASME B1.20.1.

J. Steel Pipe, Grooved-End Fittings: ASTM A 47 malleable-iron, ASTM A 106 steel, or ASTM A 536 ductile-iron, galvanized, grooved-end fittings designed to accept couplings for grooved or shouldered joints.

K. Ductile-Iron Pipe, Grooved-End Fittings: ASTM A 47 malleable-iron or ASTM A 536 ductile-iron, AWWA-pipe-size, grooved-end fittings having cement lining or FDA-approved interior coating, designed to accept AWWA C606 couplings, for AWWA grooved joints.

L. Cast-Iron Threaded Flanges: ASME B16.1, Classes 125 and 300.

M. Ductile-Iron and Gray-Iron Gasketed Fittings: AWWA C110 standard pattern or ductile-iron AWWA C153 compact pattern, 250 psig minimum pressure rating, with AWWA C104 cement-mortar lining and AWWA C111 rubber gaskets.

N. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110, 250-psig minimum pressure rating, with AWWA C104 cement-mortar lining.

O. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends conforming to AWWA C110 or AWWA C153. Units have 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250 psig minimum working pressure and with FDA-approved epoxy interior coating, for offset and expansion indicated.

P. Ductile-Iron Deflection Fittings: Compound coupling fitting with sleeve and flexing sections, gaskets, and restrained-joint ends conforming to AWWA C110 or AWWA C153. Units rated for 250 psig minimum working pressure, and with cement lining or FDA-approved epoxy interior coating, for up to 20-degrees deflection.

Q. Ductile-Iron Expansion Joints: 3-piece assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron bell and spigot end sections conforming to AWWA C110 or AWWA C153. Units rated for 250 psig minimum working pressure, and with cement lining or FDA-approved epoxy interior coating, for expansion indicated.

R. Polyethylene Encasement: AWWA C105, 8-mil minimum thickness, tube or sheet.

S. Steel Expansion Joints: Compound galvanized steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip pipe telescoping section.
   1. Pressure Rating: 150 psig minimum.
   2. Interior Lining: FDA-approved epoxy coating.

T. Hub and Spigot, Cast-Iron Soil Pipe Fittings: ASTM A 74, Service Class.

U. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301.

V. Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings: ASTM D 2661, made to ASTM D 3311, socket-type, drain, waste, and vent pipe patterns.

W. Acrylonitrile-Butadiene-Styrene (ABS) Plastic Tubular Fittings: ASTM F 409, accessible and replaceable, solvent-cement and threaded types, drain pattern.

X. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Tube Fittings: ASTM D 2846, socket-type fittings.

Y. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Threaded Pipe Fittings: ASTM F 437, Schedule 80.

Z. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic, Schedule 40, Socket-Type Pipe Fittings: ASTM F 438.

AA. Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic, Schedule 80, Socket-Type Pipe Fittings: ASTM F 439.

BB. Cast-Brass Fittings for Polybutylene (PB) Plastic Pipe: Compression fittings or flare fittings, made to PB pipe dimensions.

CC. Molded Polyethylene (PE) Plastic Fittings: ASTM D 3350 PE resin, socket-type and butt-fusion type, made to PE pipe dimensions.

DD. Cast-Brass Fittings for Polyethylene (PE) Plastic Pipe: Compression fittings or flare fittings, made to PE pipe dimensions.

EE. Plastic Fittings for Polyethylene (PE) Plastic Pipe: ASTM D 2609, insert-type, with serrated end or threaded ends, as required, and with corrosion-resistant bands or corrosion-resistant crimp rings.

FF. Poly(Vinyl Chloride) (PVC) Plastic, DWV Pipe Fittings: ASTM D 2665, made to ASTM D 3311; socket-type; drain, waste, and vent pipe patterns.

GG. Poly(Vinyl Chloride) (PVC) Plastic Tubular Fittings: ASTM F 409, accessible and replaceable, solvent-cement and threaded types, drain pattern.

HH. Poly(Vinyl Chloride) (PVC) Plastic, Threaded Pipe Fittings: ASTM D 2464, Schedule 80.

II. Poly(Vinyl Chloride) (PVC) Plastic, Schedule 40, Socket-Type Pipe Fittings: ASTM D 2466.

JJ. Poly(Vinyl Chloride) (PVC) Plastic, Schedule 80, Socket-Type Pipe Fittings: ASTM D 2467.

2.4 JOINING MATERIALS

A. Solder, brazing, and welding filler metals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene rubber gaskets and lubricant.

C. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.

2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.
3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.

D. CISPI Couplings for Hubless Cast-Iron Soil Pipe and Fittings: CISPI 310, having ASTM C 564 neoprene sealing sleeve, with 300 Series stainless-steel corrugated shield-and-clamp assembly.

E. Stainless Steel, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene sealing gasket, with Type 304 stainless-steel housing or shield and stainless-steel clamps. Coupling shall be 3 inches wide in sizes 1-1/2 to 4 inches and 4 inches wide in sizes 5 to 10 inches.

F. Cast-Iron, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene sealing gasket, with cast-iron housing and stainless steel bolts.

G. FM-Type, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: FM-approved, ASTM C 564 elastomeric sleeve, with stainless steel band and strips or cast-iron housing and corrosion-resistant bolts.

H. Sleeve-Type Couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric sleeve and stainless steel band assembly, fabricated to match outside diameters of pipes to be joined.
1. Sleeves: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Sleeves for dissimilar or other pipe materials shall be compatible with pipe materials being joined.
2. Bands: Stainless steel, one at each pipe insert.

I. Gasket-Type Couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub and adjoining pipe outside diameter.
1. Gaskets: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

J. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having enamel finish, with synthetic-rubber gasket having central-cavity, pressure-responsive design, with ASTM A 183 carbon-steel bolts and nuts, locking pin or toggle, or lugs to secure grooved pipe and fittings and gasket suitable for hot water, except where otherwise indicated.

K. Couplings for Grooved-End Ductile-Iron Pipe and Fittings: AWWA C606, consisting of ASTM A 536 ductile-iron housing having enamel finish, with synthetic-rubber gasket having central-cavity, pressure-responsive design, with ASTM A 183 carbon-steel bolts and nuts to secure grooved pipe and fittings and gasket suitable for hot water, except where otherwise indicated.

L. Couplings for Grooved-End Copper Tube and Grooved-End Copper Fittings: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having copper-colored enamel finish, with synthetic-rubber gasket having central-cavity, pressure-responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.

2.5 VALVES

A. Refer to Division 15 Section "Valves" for globe, ball, butterfly, and check valves.

B. Refer to Division 15 Section "Plumbing Specialties" for special-duty valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PREPARATION OF FOUNDATION FOR BURIED PIPING

A. Grade trench bottom to provide smooth, firm, stable, and rock-free foundation throughout length of piping.

B. Remove unstable, soft, and unsuitable materials at surface on which piping is to be laid and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of piping. Fill unevenness with tamped-sand backfill. Dig bell holes at each pipe joint to relieve bells of loads and to ensure continuous bearing of pipe barrel on foundation.

3.3 PIPE AND FITTINGS APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.

B. Soil, Waste, and Vent Piping Below Ground: Use the following:
1. 5 to 15 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
2. 5 to 10 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; cast-iron, heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
3. 5 and 6 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
4. 5 to 12 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings in 5- and 6-inch sizes; PVC socket-type Schedule 40 fittings in 8-inch and larger sizes; and solvent-cemented joints.
5. 2 to 4 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
6. 2 to 4 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; cast-iron, heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
7. 2 to 4 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
8. 2 to 4 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

9. 1-1/2 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; cast-iron, heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
10. 1-1/4 and 1-1/2 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
11. 1-1/4 and 1-1/2 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

C. Soil, Waste, and Vent Piping Above Ground: Use the following:
1. 5 to 15 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
2. 5 to 10 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
3. 5 to 10 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
4. 5 to 8 Inches: Copper drainage tube wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E solder.
5. 5 to 8 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E or Alloy Sn50 solder.
6. 5 and 6 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
7. 5 to 12 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings in 5- and 6-inch sizes; PVC socket-type Schedule 40 fittings in 8-inch and larger sizes; and solvent-cemented joints.
8. 2 to 4 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
9. 2 to 4 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
10. 2 to 4 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
11. 2 to 4 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E solder.
    a. 2-1/2- and 3-1/2-Inch Vent Piping Option: Hard copper, Type M water tube; wrought-copper or cast-copper-alloy pressure fittings; and soldered joints with Alloy E or Alloy Sn50 solder.
12. 2 to 4 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E or Alloy Sn50 solder.
13. 2 to 4 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
14. 2 to 4 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
15. 1-1/2 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
16. 1-1/4 and 1-1/2 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E solder.
17. 1-1/2 and 1-1/2 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E or Alloy Sn50 solder.
18. 1-1/4 and 1-1/2 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

19. 1-1/4 and 1-1/2 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

D. Storm Drainage Piping Below Ground: Use the following:
1. 5 to 15 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
2. 5 to 10 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, cast-iron heavy-duty couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
3. 5 and 6 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
4. 5 to 12 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings in 5- and 6-inch sizes; PVC socket-type Schedule 40 fittings in 8-inch and larger sizes; and solvent-cemented joints.
5. 2 to 4 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
6. 2 to 4 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, cast-iron heavy-duty couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
7. 2 to 4 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
8. 2 to 4 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

E. Storm Drainage Piping Above Ground: Use the following:
1. 5 to 15 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
2. 5 to 10 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
3. 5 to 10 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
4. 5 to 8 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E solder.
5. 5 to 8 Inches: Copper drainage tube, wrought-copper or cast-copper-alloy drainage fittings, and soldered joints with Alloy E or Alloy Sn50 solder.
6. 5 and 6 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
7. 5 to 12 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings in 5- and 6-inch sizes; PVC socket-type Schedule 40 fittings in 8-inch and larger sizes; and solvent-cemented joints.
8. 2 to 4 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.
9. 2 to 4 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
10. 2 to 4 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.
11. 2 to 4 Inches: Acrylonitrile-butadiene-styrene (ABS) plastic pipe; ABS socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
12. 2 to 4 Inches: Poly(vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

3.4 PIPING INSTALLATION, GENERAL

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.5 SERVICE ENTRANCE PIPING

A. Extend building storm drain piping and connect to building storm sewer piping of size and in location indicated for service entrance to building. Install cleanout and extension to grade at connection of building storm drain and building storm sewer. Storm sewerage piping is specified in separate Section of Division 2.

B. Extend building sanitary drain piping and connect to sanitary sewer piping of size and in location indicated for service entrance to building. Install cleanout and extension to grade at connection of building sanitary drain and building sanitary sewer. Sanitary sewerage piping is specified in separate Section of Division 2.

C. Install sleeve and mechanical sleeve seal at service penetrations through foundation wall for watertight installation.

3.6 DRAINAGE AND VENT PIPING INSTALLATION

A. Install cast-iron soil pipe and cast-iron soil pipe fittings according to CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

B. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-Y-branch and 1/8-bend fittings where 2 fixtures are installed back to back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

C. Lay buried building drains beginning at low point of each system, true to grades and alignment indicated, with unbroken continuity of invert. Place hub or bell ends of piping facing upstream. Install required gaskets according to manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in piping and pull past each joint as completed.

D. Install drainage and vent piping at the following minimum slopes, except where another slope is indicated:
   1. Sanitary Building Drain: 1/4 inch per foot (2 percent). 1/8 inch per foot (1 percent) for piping 4 inches and larger if first approved by Administrative Authority.
   2. Horizontal Sanitary Drainage Piping: 1/4 inch per foot (2 percent).
   3. Storm Building Drain: 1/8 inch per foot (1 percent).
   4. Horizontal Storm Drainage Piping: 1/8 inch per foot (1 percent).

E. Install underground plastic drainage piping according to ASTM D 2321.

F. Sleeves are not required for cast-iron soil pipes passing through concrete slab, without membrane waterproofing, on grade.

G. Install ABS drainage pipe and fittings according to ASTM D 2661.

H. Install PVC drainage pipe and fittings according to ASTM D 2665.

3.7 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Grooved Pipe and Grooved-Pipe Fitting Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Grooved Copper Tube and Grooved-Tube Fitting Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Cast-Iron Soil Pipe and Cast-Iron Soil Pipe Fitting Joints: Make joints according to recommendations in CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Compression Joint: Make with neoprene gasket matching class of pipe and fittings.
   2. Hubless Joint: Make with neoprene gasket and sleeve or clamp.

E. ABS DWV Pipe: Join ABS drainage pipe and fittings according to ASTM D 2661.

F. PVC DWV Pipe: Join PVC drainage pipe and fittings according to ASTM D 2665.

G. ABS to PVC Transition Joints: Make nonpressure transition joint between ABS and PVC drainage components, using fittings, solvent cements, and procedure conforming to ASTM D 3138.

H. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings with solvent cements.

I. PB Heat-Fusion and Compression Joints: Conform to ASTM D 3309.

3.8 FIELD QUALITY CONTROL

A. Inspect drainage piping as follows:
   1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
   2. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.
      a. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.

b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.

3. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
4. Reports: Prepare inspection reports signed by the plumbing official.

B. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:

1. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test piping of plumbing drainage and venting systems on completion of roughing-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1-inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 COMMISSIONING

A. Before operating systems, perform these steps:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to full open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used, clean, and ready for use.

B. Check plumbing equipment and verify proper settings, adjustments, and operation.

C. Check plumbing specialties and verify proper settings, adjustments, and operation.

D. Energize pumps and verify proper operation.

3.10 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or when work stops.

END OF SECTION 15411

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plumbing specialties for water distribution systems; soil, waste, and storm drainage systems.

B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 15 Section "Basic Mechanical Materials and Methods" for piping-joining materials, joint construction, basic installation requirements, and labeling and identifying requirements.
2. Division 15 Section "Valves" for ball, butterfly, globe, and check valves.
3. Division 15 Section "Plumbing Piping" for piping and connections.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working pressure ratings, except where otherwise indicated:
1. Soil and Waste Systems: 10-foot head of water.
2. Storm Drainage Systems: 10-foot head of water.

1.4 SUBMITTALS

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

B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
1. Cleanouts, cover plates, and access panels.
2. Sleeve penetration systems.
3. Roof flashing assemblies.
4. Floor drains, open receptors, trench drains, and roof drains.

1.5 QUALITY ASSURANCE

A. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

B. Electrical Component Standard: NFPA 70, "National Electrical Code."

C. Listing and Labeling: Provide equipment that is listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below. Package them with protective covering for storage and identify with labels clearly describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Sleeve Penetration Systems:
      a. Proset Systems, Inc.
   2. Cleanouts:
      a. Jones Manufacturing Co., Inc.
      b. Josam Co.
      c. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
      d. Wade Div., Tyler Pipe.
      e. Watts.
      f. Zurn by Hydromechanicas Div., Zurn Industries, Inc.
   3. Floor and Roof Drains:
      a. Jones Manufacturing Co., Inc.
      b. Josam Co.
      c. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
      d. Wade Div., Tyler Pipe.
      e. Watts.
      f. Zurn by Hydromechanics Div., Zurn Industries, Inc.

2.2 MISCELLANEOUS PIPING SPECIALTIES

A. Piping specialties such as escutcheons, dielectric fittings, sleeves, and sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Roof Flashing Assemblies: Manufactured assembly consisting of 4-psf lead flashing collar with boot and skirt extending at least 8 inches from pipe, with galvanized steel boot reinforcement and counterflashing fitting.
   1. Option 1: Open top.
   2. Option 2: Low-silhouette model with vandal-proof vent cap.
   3. Option 3: Extended model with field-installed, vandal-proof vent cap.

2.3 CLEANOUTS

A. General: Size cleanouts as indicated on drawings, or where not indicated, same size as connected drainage piping. Cleanouts larger than 4 inches are not required except where indicated.

B. Cleanouts: ASME A112.36.2M, cast-iron body with straight threads and gasket seal or taper threads for plug, flashing flange and clamping ring, and a brass closure plug.

C. Plastic Cleanouts: Fabricate units of plastic pipe and fittings, with removable threaded plastic closure plug. See Product Data Sheet at end of Part 3 of this Section for separate deck plate, top-loading classification, and finish, when required; for access covers when required; and other specific features.

2.4 ROOF DRAINS

A. General: Size outlet as indicated on drawings.

B. Roof Drains: ASME A112.21.2M, cast-iron body, with combination flashing ring and gravel stop, cast-iron dome, extension collars, underdeck clamp, and sump receiver. Roof drains for installation in cast-in-place concrete decks may be furnished without underdeck clamp and sump receiver. See Product Data Sheet at end of Part 3 of this Section for dimensions, sump size, dome material, and specific features.

C. Plastic Roof Drains: ASME A112.21.2M standard design and pattern except for material. See Product Data Sheet at end of Part 3 of this Section for specific features.

D. Expansion Joints: ASME A112.21.1M, assembly for roof drain outlet, consisting of cast-iron body, with bronze sleeve, packing gland, and packing, of size and end types corresponding to connected piping.
   1. Size: Same as roof drain outlet when connected to roof drain and same as connected piping when installed in piping.

E. Downspout Nozzles: Cast-bronze body with threaded inlet for pipe size indicated, and cast-bronze wall flange with mounting holes.
   1. Finish: Polished bronze.
   2. Finish: Nickel bronze.

2.5 SLEEVE PENETRATION SYSTEMS

A. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
   1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on 1 end for installation in cast-in-place concrete slabs.

2.6 FLASHING MATERIALS

A. Lead: ASTM B 749, Type L51121, copper-bearing sheet, at least 4 psf (0.0625-inch thick) for general use, and at least 6 psf (0.0937-inch thick) for burning (welding), except as otherwise indicated.

B. Elastic Membrane: Nonreinforced flexible, black elastic, sheet, 50 to 65-mils thick and complying with the following:
   1. Shore A Hardness: ASTM D 2240, 50 to 70.
   2. Tensile Strength: ASTM D 412, 1200 psi.
   3. Tear Resistance: ASTM D 624, Die C, 20 lb per linear inch.
   4. Ultimate Elongation: ASTM D 412, 250 percent.
   5. Low-Temperature Brittleness: ASTM D 746, minus 30 deg F (minus 35 deg C).
   6. Resistance to Ozone Aging: ASTM D 1149, no cracks for 10 percent elongated sample for 100 hours in 50-mPa ozone at 104 deg F (70 deg C).
   7. Resistance to Heat Aging: ASTM D 573, maximum hardness increase of 15 points, elongation reduction of 40 percent, and tensile strength reduction of 30 percent, for 70 hours at 212 deg F (100 deg C).

C. Zinc-Coated Steel: ASTM A 526, sheet, with 0.20 percent copper, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gage) except as otherwise indicated.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units as required for installation; matching or compatible with material being installed.

F. Bituminous Coating: SSPC-12, solvent type, bituminous mastic.

PART 3 - EXECUTION

3.1 PIPING SPECIALTY INSTALLATION

A. Install cleanouts in above-ground piping and building drain piping as indicated, and where not indicated, according to the following:
   1. Size same as drainage piping up to 4-inch size. Use 4-inch size for larger drainage piping except where larger size cleanout is indicated.
   2. Locate at each change in direction of piping greater than 90 degrees.
   3. Locate at maximum intervals of 50 feet for piping 4 inches and smaller and 75 feet for larger piping.
   4. Locate at base of each vertical soil, waste, or roof drainage stack.
   5. Locate at upper terminal of each branch waste line 5'-0" long or longer.
   6. Install cleanout at each plumbing fixture.

3.2 ROOF DRAIN INSTALLATION

A. Install roof drains at low points of roof areas, according to the roof membrane manufacturer's installation instructions.

B. Install drain flashing collar or flange so no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

C. Position roof drains for easy accessibility and maintenance.

3.3 FLASHING INSTALLATION

A. Provide flashing manufactured in a single piece except where large pans, sumps, or other drainage shapes are required.

B. Install 4-psf lead flashing or 16-oz.-per sq. ft. copper, except when another weight or material is specified.

C. Install 6-psf lead flashing or heavier where burning (welding) of lead sheets is required.

D. Solder joints of copper sheets where required.

E. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with membrane waterproofing.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum sleeve length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

F. Set flashing on floors and roofs in solid coating of bituminous cement.

G. Secure flashing into sleeve and specialty clamping ring or device.

H. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

I. Fabricate and install lead sheet flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection when indicated. Provide 36" X 36" 4-psf lead flashing at each roof drain.

J. Fabricate and install elastic-membrane sheet flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection when indicated. Provide 36" X 36" flashing at each roof drain.

3.4 COMMISSIONING

A. Preparation: Perform the following checks before start-up:
   1. Systems tests are complete.
   2. Damaged and defective specialties and accessories have been replaced or repaired.
   3. There is clear space for servicing of specialties.

B. Before operating systems, perform these steps:
   1. Verify drainage and vent piping are clear of obstructions. Flush with water until clear.

3.5 ADJUSTING

A. Adjust operation and correct deficiencies discovered during commissioning.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures related to startup and servicing of interceptors.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or when work stops.

3.8 PLUMBING SPECIALTY DATA SHEETS

A. Cleanouts:

1. Exterior Cleanouts (Cleanout to Grade): Smith figure 4253 Duco cast iron cleanout and double flanged housing with heavy duty secured scoriated cast iron cover with lifting device, taper threaded bronze plug and spigot outlet.

B. Roof Drains

RD-1 Roof Drain: Smith figure 1010-ERC cast iron body with combined flashing clamp and cast iron gravel stop, cast iron dome, extension, sump receiver and underdeck clamp.

END OF SECTION 15430

SECTION 15815 - METAL DUCTS

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. "Basic Mechanical Requirements."
2. "Basic Mechanical Materials and Methods."

1.2 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gage.

B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 7 Section "Joint Sealant" for fire-resistant sealants for use around duct penetrations and fire damper installations in fire rated floors, partitions, and walls.
2. Division 15 Section "Mechanical Insulation" for exterior duct and plenum insulation.
3. Division 15 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, and turning vanes.
4. Division 15 Section "Testing, Adjusting, and Balancing."

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.5 SUBMITTALS

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

B. Duct shop drawings and duct work coordination drawings shall not be submitted to the architect, but shall be available at the job site for coordination, with the exception of exposed ducts in finished areas. Submit shop drawings to Architect showing exposed ducts in all finished areas.

C. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
   1. Duct Liner.
   2. Sealing Materials.
   3. Fire-Stopping Materials.

D. Shop drawings from duct fabrication shop, drawn to a scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as the Contract Drawings, detailing:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
   3. Fittings.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire-rated and other partitions.
   7. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

E. Coordination drawings for ductwork installation in accordance with Division 15 Section "Basic Mechanical Requirements." In addition to the requirements specified in "Basic Mechanical Requirements" show the following:
   1. Coordination with ceiling suspension members.
   2. Special coordination with other systems installed in the same space with the duct systems.
   3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
   4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.

F. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.

G. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 15 Section "Basic Mechanical Requirements" and Division 1.

H. Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 15 Section "Basic Mechanical Requirements."

1.6 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."

B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.

C. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Store duct liner to protect from moisture. Wet duct liner, even though dried, must be replaced with new material. No exceptions.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in thicknesses indicated (minimum 26 gauge), packaged and marked as specified in ASTM A 700.

B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

C. PVC-Coated Galvanized Steel: UL-181 Class 1 Listing. Lock-forming quality galvanized sheet steel with ASTM A 527, Coating Designation G 90. Provide with factory-applied, 4-mil, PVC coating on the exposed surfaces of ducts and fittings (interior of ducts and fittings for acid-resistant applications) and 2-mil PVC coating on the reverse side of the ducts and fittings.

D. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DUCT LINER

A. General: Comply with NFPA Standard 90A and TIMA Standard AHC-101.

B. Materials: ASTM C 1071, Type II, fiberglass duct liner with acrylic coated surface exposed to airstream to prevent erosion of glass fibers and treated with EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.

1. Thickness: 1 inch.
2. Density: 1-1/2 pounds.
3. Thermal Performance: "K-Factor" equal to 0.28 or better, at a mean temperature of 75 deg F, ASTM C 518.
4. Noise Reduction Coefficient: 0.55 or higher based on "Type A Mounting" and tested in accordance to ASTM C 423. (1.5 pcf, 1" thickness)
5. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.
6. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.
7. Maximum Velocity: 5,000 ft./min.
8. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
   a. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the airstream.
   b. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

2.3 SEALING MATERIALS

A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

C. Joint and Seam Sealant: One-part, nonsag, solvent- release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

D. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.4 FIRE-STOPPING

A. Fire-Resistant Sealant: Fire-resistant sealant products are Specified in Division 7 Section "Firestopping."

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.

B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
   1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped- galvanized rods with threads painted after installation.
   2. Straps and Rod Sizes: Conform with Tables 4-1, 4-1M, and 4-2 in SMACNA "HVAC Duct Construction Standards," 1995 Edition, for sheet steel width and gage and steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
   1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
   2. For stainless steel ducts, provide stainless steel support materials.
   3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

2.6 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Tables 1-3 through 1-25, including their associated details. Conform to the requirements in the referenced standard for metal thickness (minimum 26 gauge), reinforcing types and intervals, tie rod applications, and joint types and intervals.
   1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
   2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
   3. All rectangular low pressure supply air, transfer air, relief air, and return air ducts shall be acoustically lined on the inside with 1" thick duct liner unless otherwise noted. All elbows and fittings shall be insulated. Exterior ducts shall be lined with 2" duct liner. Exhaust air ducts are not to be lined unless otherwise noted.

B. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-8.

2.7 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Duct Construction Standard," 1995 Edition, Figures 2-1 through 2-18.
   1. Elbows:
      a. Type RE-1 radius elbow with 1-1/2 W radius.
      b. Type RE-2 square throat elbow with single thickness turning vanes.
      c. Type RE-5 dual radius elbow.

2.8 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.

B. Apply a coat of adhesive to transverse and longitudinal liner edges.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.

E. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.
   1. Apply an adhesive coating on longitudinal seams.

F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

G. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:
   1. Fan discharge.
   2. Intervals of lined duct preceding unlined duct.

H. Where noted on drawings, secure insulation liner with perforated sheet metal liner of the same gage specified for the duct, secured to ducts with mechanical fasteners that maintain metal liner distance from duct without compressing insulation. Provide 3/32-inch-diameter perforations, with an overall open area of 23 percent.

I. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

2.9 ROUND AND FLAT OVAL DUCT FABRICATION

A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given sized of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.

B. Round Ducts: Fabricate round supply ducts with spiral lockseam construction, except where diameters exceed 72 inches. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Table 3-2 for galvanized steel gages(minimum 26 gauge).

C. Single Wall Lined Ducts: All interior exposed low pressure supply air round ducts and fittings shall be double wall or lined with 1" thick duct liner unless noted otherwise.
   1. Install the duct liner in accordance with the manufacturer's recommendations.

D. Double-Wall Insulated Ducts: Fabricate double-wall insulated ducts with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.
   1. Thermal Conductivity: 0.28 Btu/sq.ft./deg F/inch thickness at 75 deg F mean temperature.
   2. Outer Shell: Base outer shell gage on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation, and in gages specified above for single-wall duct.
   3. Insulation: Unless otherwise indicated, provide 2-inch-thick fiber-glass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the inner liner diameter.
   4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gages listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
   5. Perforated Inner Liner: Construct round and flat oval inner liners with perforated sheet metal of the gages listed below. Provide 3/32-inch-diameter perforations, with an overall open area of 23 percent. For flat oval ducts, the diameter indicated below is the "basic round diameter."
      a. 3 to 8 inches: 28 gage with standard spiral construction.
      b. 9 to 42 inches: 28 gage with single-rib spiral construction.
      c. 44 to 60 inches: 26 gage with single-rib spiral construction.
      d. 62 to 88 inches: 22 gage with standard spiral construction.
   6. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.10 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 3-4 to 3-6 and with metal thicknesses (minimum 26 gauge) specified for longitudinal seam straight duct.
   1. Tees: 90° tee with oval to round tap. Conical tees.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.
   a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Table 3-1.
   b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
      1) 3 to 26 inches: 24 gage.
      2) 27 to 36 inches: 22 gage.
      3) 37 to 50 inches: 20 gage.
      4) 52 to 60 inches: 18 gage.
      5) 62 to 84 inches: 16 gage.
   c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:
      1) 3 to 14 inches: 24 gage.
      2) 15 to 26 inches: 22 gage.
      3) 27 to 50 inches: 20 gage.
      4) 52 to 60 inches: 18 gage.
      5) 62 to 84 inches: 16 gage.
   d. Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.
   e. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.
2. Round Elbows - 8 Inches and Smaller: Die-formed or stamped elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored or segmented construction.
3. Round Elbows - 9 Through 14 Inches: Gored or segmented or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored or segmented construction.
4. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored or segmented elbows, except where space restrictions require a mitered elbow.
5. Die-Formed or Stamped Elbows for Sizes Through 8 Inches and All Pressures: 20 gage with 2-piece welded construction.
6. Round Gored or Segmented Elbows Gages: Same as for nonelbow fittings specified above.
7. Flat Oval Elbows Gages: Same as longitudinal seam flat oval duct.
8. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26 gage.

D. Single Wall Lined Ducts: All interior exposed low pressure supply air round ducts and fittings shall be double wall or lined with 1" thick duct liner unless noted otherwise.

1. Install the duct liner in accordance with the manufacturer's recommendations.

E. Double-Wall Insulated Fittings: Fabricate double-wall insulated fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.

1. Thermal Conductivity: 0.28 Btu/sq.ft./deg F/inch thickness at 75 deg F mean temperature.
2. Outer Shell: Base outer shell gage on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation. Gages for outer shell shall be same as for uninsulated fittings specified above.
3. Insulation: Unless otherwise indicated, provide 2-inch-thick fiber-glass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.
4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gages listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
5. Perforated Inner Liner: Construct round and flat oval inner liners with perforated sheet metal of the gages listed below. Provide 3/32-inch-diameter perforations, with an overall open area of 23 percent. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
   a. 3 to 34 inches: 24 gage.
   b. 35 to 58 inches: 22 gage.
   c. 60 to 88 inches: 20 gage.
6. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

F. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches: 2-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with a PVC aerosol spray.
2. Round Elbows 9 to 26 Inches: Standing seam construction.
3. Round Elbows 28 to 60 Inches: Standard gore construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slip-joint construction with a minimum of a 2-inch insertion length.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

1. High pressure supply duct between fan unit and terminal boxes: 6 inches w.g. positive.
2. Low pressure supply duct between fan units and room outlets: 3 inches w.g. positive.
3. Low pressure supply duct between terminal boxes and room outlets: 1 inch w.g. positive.
4. Exhaust air duct when fan rated at 2 inches w.g. sp or lower, return air duct, transfer air duct, combustion air duct, outside air duct: 2 inches w.g. negative.
5. Laboratory exhaust air duct: 2 inches w.g. negative.

B. Install ducts with the fewest possible joints.

C. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

H. Install insulated ducts with 1-inch clearance outside of insulation.

I. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

J. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

M. Fire-Rated Penetrations: Comply with Division 7 Section "Firestopping."

N. Protect lined duct from moisture. Wet duct liner, even though dried, must be replaced. No exceptions.

O. Install automatic temperature control dampers, air flow measuring stations and other duct mounted devices.

P. Interior of ducts shall be kept clean. Protect ducts from dust, dirt, debris, etc., by covering exposed ends of ducts during storage and construction. Ducts which become dirty shall be cleaned to satisfaction of the Engineer and Owner.

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints as follows:

B. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations.

C. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams and duct penetrations.

D. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only and duct penetrations.

E. Seal externally insulated ducts prior to insulation installation.

F. Ducts exposed to view shall have tape sealer in a neat manner. Paint tape sealer on unpainted ducts to match duct.

3.3 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," 1995 Edition, Tables 4-1 through 4-3 and Figures 4-1 through 4-9.

B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install concrete insert prior to placing concrete.

F. Install powder actuated concrete fasteners after concrete is placed and completely cured.

G. Steel roof deck shall not be used to support loads from ductwork or equipment, unless noted otherwise.

H. Ducts exposed to view shall be supported using threaded rod or some other method that is neat in appearance. Straps are not an acceptable method of hanging ducts that are exposed to view.

I. Seismic bracing for ducts exposed to view must be neat in appearance. Proposed method shall be submitted to the Architect prior to duct installation.

3.4 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 15 Section "Duct Accessories."

B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 2-5 and 2-6.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 2-14 through 2-17.

D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figure 2-17.

3.5 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.

B. Conduct tests, in the presence of the Architect or Owner's representative, at static pressures equal to the maximum design pressure of the system or the section being tested. If pressure classifications are not indicated, test entire system at the maximum system design pressure. Do not pressurize systems above the maximum design operating pressure. Check duct system for audible leaks. Give 7 days' advanced notice for testing.

C. Maximum Allowable Leakage: As described in ASHRAE 1997 Handbook, "Fundamentals" Volume, Chapter 32, Table 6 and Figure 14. Comply with requirements for leakage classification 3 for round and flat oval ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2 inches water gage (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2 inches water gage and less than and equal to 10 inches water gage.

D. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

E. Leakage Test: Perform volumetric measurements and adjust air systems as described in ASHRAE 1995 "HVAC Systems and Applications" Volume, Chapter 34 and ASHRAE 1997 "Fundamentals" Volume, Chapter 14, and Division 15 Section "TESTING, ADJUSTING, AND BALANCING."

3.6 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 15 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.

B. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Manual volume control dampers.
2. Fire and smoke dampers.
3. Combination fire/smoke dampers.
4. Duct silencers.
5. Turning vanes.
6. Duct-mounted access doors and panels.
7. Flexible connectors.
8. Flexible ducts.
9. Accessories hardware.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 8 Section "Access Doors and Frames" for ceiling- and wall-mounted access panels and doors.

1.3 SUBMITTALS

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

B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
1. Manual volume control dampers.
2. Fire and smoke dampers.
3. Combination fire/smoke dampers.
4. Duct-mounted access panels and doors.
5. Duct silencers.
6. Flexible ducts.

C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
1. Special fittings and volume control damper installation (both manual and automatic) details.
2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.

D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA Standards:
1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME CONTROL DAMPERS

A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.

B. Standard Volume Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
2. Roll-Formed Steel Blades: 16-gage galvanized steel.
3. Blade Axles: Galvanized steel.
4. Tie Bars and Brackets: Galvanized steel.

C. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within a pipe bearing assembly mounted on supports at each mullion and at each end of multiple damper assemblies. Provide appropriate length and number of mounting to connect linkage of each damper of a multiple damper assembly.

D. Damper Control Hardware: Zinc-plated, die-cast core with a heavy-gage dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Provide center hole to suit damper operating rod size. Provide elevated platform for insulated duct mounting. Provide gasketing to reduce air leakage.

E. Concealed Damper Regulators: Provide for each damper located above a non-accessible type ceiling a concealed damper regulator with zinc finished cover plate for field painting. Provide additional hardware such as couplings, bearing, or rods that may be required to connect the concealed damper regulator to the damper.

2.2 FIRE DAMPERS

A. General: UL labeled according to UL Standard 555 "Standard for Fire Dampers." Fire dampers to be dynamic with ability to close with fan system on.

B. Fire Rating: 1-1/2 hours for fire resistive assemblies rated 2 hours or less, 3 hours for fire resistive assemblies rated 3 hours or more.

C. Frame: Type A, Type B, or Type C; fabricated with roll-formed, galvanized-steel; with mitered and interlocking corners. Type C frame sealed air tight.

D. Mounting Sleeve: Factory-installed or field-installed galvanized steel.
1. Minimum Thickness: Thickness to meet UL listing requirements, and length to suit application.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, galvanized steel. In place of interlocking blades, provide full-length, galvanized-steel blade connectors.

G. Dynamic Closing: Include a blade lock and stainless steel negator closure spring for all units.

H. Fusible Link: Replaceable, 165 deg F rated unless otherwise indicated.

2.3 CEILING FIRE DAMPERS

A. General: UL listed and labeled according to UL 555C "Standard for Ceiling Radiation Dampers"; comply with the construction details for the tested floor/roof-ceiling assemblies as indicated in the UL Fire Resistance Directory.

B. Fire Rating: 3 hours for fire resistive assemblies rated 3 hours or less.

C. Frame: Rectangular or round, galvanized steel; style to suit ceiling construction.

D. Blades: Galvanized steel with nonasbestos refractory insulation.

E. Fusible Link: Replaceable, 165 deg F rated.

2.4 SMOKE DAMPERS

A. General: UL-labeled according to UL Standard 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems." Leakage Class II, 350 deg F temperature category.

B. Frame and Blades: Galvanized steel.

C. Mounting Sleeve: Factory-installed, galvanized steel, thickness to meet UL listing requirements, length to suit application.

D. Actuator: UL listed smoke damper actuator, factory installed, 2 position action, normally closed, electric 120/1/60.

2.5 DUCT SILENCERS

A. General: Provide factory-fabricated and -tested round or rectangular silencer with performance characteristics and physical requirements as indicated.

B. Fire Performance: Adhesives, sealers, packing material, and accessory materials shall have fire ratings not exceeding 25 for flame spread and 50 for smoke developed when tested according to ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

C. Rectangular Units: Fabricate casings with a minimum of 22-gage solid sheet metal for outer casing and 26-gage perforated sheet metal for inner casing.

D. Round Units: Provide casings with sheet metal thicknesses for the casing diameters as listed below:
1. Up to 24 inches: 22 gage.
2. 26 through 40 inches: 20 gage.
3. 42 through 52 inches: 18 gage.
4. 54 through 60 inches: 16 gage.
5. Casings fabricated of spiral lock seam duct may be 2 gages lighter than that indicated.
6. Interior Partitions and Baffles: At least 22 gage, and designed for minimum aerodynamic losses.

E. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.

F. Nonfibrous Acoustic Fill Material: Moisture-proof, nonfibrous material meeting the acoustic performance requirements.

G. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
1. Do not use nuts, bolts, and sheet metal screws for unit assemblies.
2. Lock form and seal or continuously weld joints.
3. Suspended Units: Provide factory-installed suspension hooks or lugs attached to the frame in quantities and spaced to prevent deflection or distortion.
4. Reinforcement: Provide cross angles or trapeze angles for rigid suspension.

H. Source Quality Control: Perform the following factory tests:
1. Acoustic Performance: Test silencers with airflow in both directions through silencer, according to ASTM E 477, "Methods of Testing Duct Liner Materials and Prefabricated Silencers for Acoustical and Airflow Performance."
2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels for both forward flow (air and noise in same direction) and reverse flow (air and noise in opposite directions) with an airflow of at least 2,000 FPM face velocity.

3. Leak Test: Test units for airtightness at 200 percent of the associated fan static pressure or 6-inch W.G. static pressure, whichever is greater.

2.6 COMBINATION FIRE/SMOKE DAMPERS

A. General: UL-labeled according to UL Standard 555 "Standard for Fire Dampers" and UL Standard 555S "Standard for Leakage Rated Dampers for Use in Smoke Control Systems." Leakage Class II, 350 deg. F temperature category. Dampers to be dynamic with ability to close with fan system on.

B. Fire Rating: 1-1/2 hours for fire resistive assemblies rated 2 hours or less, 3 hours for fire resistive assemblies rated 3 hours or more.

C. Leakage Class: Class II.

D. Temperature Category: 350 deg. F.

E. Thermal Link: 165 deg. F rated, resetable.

F. Frame and Blades: Galvanized steel.

G. Mounting Sleeve: Factory-installed, galvanized steel, thickness to meet UL listing requirements.

H. Length to suit application.

I. Mounting: Vertical or horizontal.

J. Actuator: UL listed smoke damper actuator, factory installed, 2 position action, normally closed, electric 120/1/60.

K. Smoke Detector: UL listed ionization duct smoke detector, factory installed. 120/1/60 power requirement, wired to close damper when smoke detected in duct.

2.7 TURNING VANES

A. Fabricate turning vanes according to SMACNA HVAC Duct Construction Standards, Figures 2-2 through 2-7 except trailing edge turning vanes not allowed.

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fiber glass fill.

2.8 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.

B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

E. Insulation: 1-inch thick fiber glass or polystyrene foam board.

F. Size: 12" X 12" minimum size or 2" narrower X 12" for duct 24" wide or narrower. 18" X 18" minimum size for duct larger than 24".

2.9 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

B. Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.

C. Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
   1. Minimum Weight: 26 oz. per sq yd.
   2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

D. Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Pont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
   1. Minimum Weight: 26 oz. per sq yd.
   2. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

E. High-Temperature System Flexible Connectors Fabric: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz. per sq yd and tensile strength of 285 lb per inch in the warp, and 185 lb per inch in the filling.

F. High-Corrosive-Environment System Flexible Connectors Fabric: Glass fabric coated with a chemical-resistant coating.
   1. Minimum Weight: 14 oz. per sq yd.
   2. Tensile Strength: 450 lb per inch in the warp and 340 lb per inch in the filling.

2.10 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts - Insulated: Factory-fabricated, insulated, corrugated aluminum, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.
   1. Outer Jacket: Glass-reinforced, silver mylar with a continuous hanging tab, integral fiber glass tape, and nylon hanging cord.

C. Spin Collars:
   1. All round take-offs shall be made with spin collar type with damper. The mounting groove shall be dieformed to assure constant fit control. Balancing dampers shall be furnished with positive adjustable quadrant with locking nut for easy adjustment. Provide shafts to accommodate a concealed damper regulator where located above a non-accessible ceiling.
   2. Holes for spin-ins shall be cut with jigged tool for precise opening preparation. Joint shall be sealed air tight per 1985 SMACNA Class C Duct Sealing.

2.11 ACCESSORIES HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket, 1/4-inch, zinc-plated operating rod, and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless steel band with cadmium-plated hex screw to tighten band with a worm-gear action. Provide in sizes from 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.

E. Install fusible links in fire dampers.

F. Label fire damper, smoke damper, and combination fire/smoke damper access doors according to IMC-Current with letters not less than 1/2 inch in height reading "FIRE DAMPER", "SMOKE DAMPER", or "FIRE/SMOKE DAMPER."

G. Maximum allowable length of flex duct shall be 3'-0" at diffuser terminations.

H. Provide duct-mounted access doors as required for access at each fire damper, smoke damper, combination fire/smoke damper and ceiling fire damper, motorized control damper.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

ACCESS DOOR MATERIALS SCHEDULE

DUCT PRESSURE CLASS	DOOR SIZE INCHES	NUMBER OF HINGES	NUMBER OF LOCKS	METAL GAGE FRAME	METAL GAGE DOOR	METAL GAGE BACK
2 INCHES & LESS	12X12	2	1-S	24	26	26
	16X20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26
3 INCHES	12X12	2	1-S	22	22	26
	16X20	2	1-S,1-T,1-B	20	20	26
	24X24	3	2-S,1-T,1-B	20	20	24
4 TO 10 INCHES	12X12	2	1-S,1-T,1-B	20	20	26
	16X20	3	2-S,1-T,1-B	20	18	24
	24X24	3	2-S,2-T,2-B	18	18	24

S: SIDE
T: TOP
B: BOTTOM

END OF SECTION 15820

SECTION 15855A - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:
1. Ceiling air diffusers and grilles.
2. Wall registers and grilles.
3. Louvers.

1.3 QUALITY ASSURANCE

A. Codes and Standards:
1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Samples: 3 samples of each type of finish furnished.

C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers and grilles of type, capacity, and with accessories and finishes as listed on diffuser and grille schedule.
   1. Diffuser and Grille Finishes:
      a. Diffuser and grille finishes shall be baked enamel unless noted otherwise. Color is to be selected by the Architect.

E. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
   1. Air Guide.
   2. Anemostat Products Div.; Dymanics Corp. of America.
   3. Carnes Co.; Div. of Wehr Corp.
   4. E.H. Price Co.
   5. J and J Register.
   6. Krueger Mfg. Co.
   7. Titus Products Div.; Philips Industries, Inc.

8. Tuttle & Bailey; Div. of Interpace Corp.
9. Nailor.

2.2 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.
1. Register and Grille Finishes:
a. Register and grille finishes shall be baked enamel unless noted otherwise. Color is to be selected by the Architect.

E. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:
1. Air Guide.
2. Anemostat Products Div.; Dynamics Corp. of America.
3. Carnes Co.; Div. of Wehr Corp.
4. J and J Register.
5. Krueger Mfg. Co.
6. Titus Products Div.; Philips Industries, Inc.
7. Tuttle & Bailey; Div. of Interpace Corp.
8. Nailor.

2.3 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Louver Finish: Louver finish shall be anodized aluminum in color as selected by the Architect.

G. Manufacturer: Subject to compliance with requirements, provide louvers of one of the following:
1. Air Guide.
2. Airline Products Co.
3. Airolite Co.
4. American Warming & Ventilating Inc.
5. Arrow United Industries, Inc.
6. Carnes, Co.
7. Cesco.
8. Construction Specialties, Inc.
9. Daniel.
10. Dowco Corp.
11. E.H. Price
12. Greenheck.
13. Industrial Louvers, Inc.
14. Louvers & Dampers, Inc.
15. Penn Ventilator Co., Inc.
16. Reliable.
17. Ruskin Mfg. Co.
18. Safe-Air Inc.
19. Snyder (E.G.) Co., Inc.
20. Vent Products Co., Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

3.4 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855A

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING; MECHANICAL O&M MANUALS; AND SYSTEMS COMMISSIONING

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. Related sections include the following:
1. Division 1 Section “Quality Control” for (general requirements of testing agencies).
2. Division 15 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
3. Division 15 system sections specifying leak testing requirements and procedures.
4. Division 15 Section “System Commissioning.”

1.2 SYSTEM AIR & WATER BALANCE & TESTING

A. Division 15 shall be responsible for the mechanical system balancing and manuals and shall include in his bid the cost of a Professional Balancing Firm to do the work as outlined. The balancing work shall be under the direction of a Professional Engineer, NEBB--certified TAB supervisor--or AABC--certified TAB supervisor--with experience in balancing systems of similar types and size. Approved balancing companies are Quality Balancing Co., BTC Services, Diamond Test and Balance, Certified Testing & Balancing, RS Analysis, and Bonneville Test & Balance Company.

B. The balancing work shall include but not be limited to the following:
1. All system air and water balance work and reports.
2. Atrium smoke control system test.

C. The HVAC Sheet Metal Installer & Control Installer are to provide men to assist with problems related to the air and water balance and atrium smoke control system test. The Plumbing Installer is to provide men to assist with problems related to the water balance. The Balancing Firm shall provide all other manpower required to accomplish the balancing work.

D. Professional Balancing Firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, record all readings and see that any necessary adjustments are made.

E. Instruments shall be used and applied which are best suited to the system function being tested. Instruments shall be in first class state of repair and will have calibration certified prior to starting the job. Instruments shall be recalibrated during the balancing process if required to prove reliability.

F. Provide a suitable single line drawing for each fan system. Large fan systems may be broken into suitable zones. Drawings shall be on 8-1/2" X 11" sheets of graph paper with system and zone heading the sheet. Drawings may be free hand but must be neat and legible.

G. For each system locate on the drawing each main duct damper and each branch duct damper.

H. Identify each main duct, branch duct, and air outlet by number or letter, together with its required CFM.

I. Prepare test report sheets coordinated with contract drawings and zone sketch.

J. Make sure that all calculations and tests are based only on complete equipment data and on approved drawings.

K. All air and hydronic systems shall be balanced using an applicable proportionate procedure.

L. After all adjustments are made, a detailed written report shall be prepared and submitted for approval. Final acceptance will not be made until a satisfactory report is received and field verified.

M. The Owner's representative will field verify the report in the following manner:
   1. Select points to be tested at random. (Quantity shall not exceed 10% of total.)
   2. Require Balancing firm to read the quantities in his presence.

N. Air Balancing Procedures:
   1. Before any adjustments are made, the systems are to be checked for such items as dirty filters, duct leakage, damper leakage, equipment vibrations, correct damper operation, etc. All fan systems, major duct sections, registers, diffusers, etc., are to be adjusted to deliver design air quantities with plus or minus 10%. Individual air outlets, when one of three or more serve a space, may have a tolerance of 15% above average. Design CFM is based on filters being approximately 50% loaded with dirt. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed, check motor amperage with the filters clean.
   2. Exhaust and recirculation air systems shall be adjusted for air quantities shown on drawings and proper relationship between supply and exhaust established. Fans shall be balanced to within plus or minus 5% of design.
   3. Distribution system shall be adjusted to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.
   4. Sheaves and/or belts shall be exchanged as required to adjust the rpm of all fans so they handle specified air quantity.

O. Hydronic Balancing Procedures: Using system flow meters, the balancing firm shall adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements. Water quantities shall be balanced to within plus or minus 5% of design.

P. Miscellaneous:
   1. All installed thermal overload protection shall be observed and noted in the data sheets. If the starter equipment is incorrect, such information shall be tabulated, including required size thermal overloads, and included in the report. If thermal overload protection is incorrect, it shall be the responsibility of the balancing firm to notify in writing the Contractor and Architect so that proper overload protection is installed.
   2. The adjusting crew shall measure and set any special conditions such as minimum outside air quantities; check and adjust outside and return air intakes so that the system

will deliver substantially the same volume on either; make test and record data as required in "REPORT."

3. It will be the responsibility of the balancing firm to work with the Control Contractor during the fan system's air flow calibration. The air balance firm shall verify the flows for supply, exhaust, and return systems.
4. All balancing devices, i.e., dampers and valves, shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
5. When deemed necessary by the Architect or Engineer, 24 hour space temperature recording shall be taken and any required partial rebalance of the system shall be performed without additional cost. If adjustments are required to produce other than design requirements shown on drawings because of job conditions, these adjustments shall be made without extra cost.
6. The balancing contractor shall be responsible to set the correct flow at all variable volume and constant volume valves.

Q. Report:

1. A bound report shall be provided in the Operation and Maintenance Manual which shall contain a general information sheet listing instruments used, method of balancing, altitude correction, and manufacturer's grille, register and diffuser data.
2. Provide equipment data sheets listing make, size, serial number, rating, etc., of all mechanical equipment, including fans, pumps, motors, starters and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils and other system components, pump heads and measured motor current and voltage.
3. Balancing data sheets shall indicate the required and actual CFM of all supply, return and exhaust outlets or inlets, and shall be totaled and summarized by systems.
4. Hydronic balancing data sheets shall list required temperature or pressure differentials used for balancing coils, radiators, condensers, etc. Sheets shall show in comparison final as-balanced versus design values.
5. Reports shall contain single line drawings or reduced set of contract drawings with outlets marked thereon for easy identification of the designation used in the data sheets.
6. The report shall outline any abnormal or notable conditions not covered in the above.
7. The report shall include all measurements made under the "System Checks" section.

R. System Checks as Applicable:

1. Air Handlers:
   a. Record room or duct thermostat setpoint. Measure room temperature at thermostat and middle of room. Measure duct temperature at control sensor.
   b. Check each fan unit with the Control Contractor. Record as applicable within 30 minute period:
      1) Outside air temperature.
      2) Supply air temperature.
      3) Return air temperature.
      4) Mixed air temperature.
      5) Pre-Heat temperature.
      6) Cooling coil discharge temperature.
      7) Re-Heat coil discharge temperature.
      8) Chilled water supply temperature.
      9) Chilled water return temperature.
      10) Heating water supply temperature.
      11) Heating water return temperature.

12) Air flow CFM supply and return fans for variable volume system with volume measuring stations.

13) Pre-Heat control setpoint and discharge air control setpoint:

a) Valve branch pressures.

b) Sensor branch pressures and temperatures.

c. Set outside and return dampers at minimum position by adjusting economizer control. Measure outside air, return air and mixed air temperatures and calculate amount of outside air (measure amount of outside air if possible). This should preferably be done with outside air above freezing. With unit outside air and return air dampers under control of discharge sensor, have Control Contractor set discharge control to a call for full cooling. (This should not be done in freezing weather.) After 30 minutes, read and record all temperatures as required under first item above. Check to make sure outside air damper has opened wide.

d. Set discharge control on a call for full heating. After 15 minutes read and record all temperatures as required. Check to make sure outside air damper had closed or has closed to minimum.

e. Check outside air damper and heating valve to make sure they are operating in proper sequence.

f. With System in Cooling Mode, Repeat as Specified for Heating Mode:

1) Check outside air damper and heating valve to make sure they are operating in proper sequence.

2. Central Panel System: Field check each point on the central panel with the Control Contractor:

a. Record field measurement at sensing element location.

b. Record central panel reading at same time.

c. Field check all start-stop commands. (All stop-start commands should have electrical and flow switch verification.)

d. Field check central panel software programs.

1.3 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Division 15 shall be responsible for the Mechanical Operation and Maintenance Manuals and shall include costs for manuals in his bid.
2. Provide five (5) copies of Operations and Maintenance Manuals to the Owner.
3. Manuals must be approved by the Architect prior to turning them over to the Owner.
4. The Manuals shall be prepared by the Balancing Contractor.

B. Binders:

1. Binders shall be Red Buckram binders with easy view metal for sheet size 11" X 8-1/2" with expandable metal capacity as required for the project, rivet through construction with library corners using #12 BB and lining with same materials as cover, front cover and back-bone foil stamped in white. Print as follows:

OPERATING & MAINTENANCE
MANUAL
FOR THE
(LIST PROJECT NAME)

2. Binders shall be as manufactured by Hiller Bookbinding or equal.
3. The master index sheet and each tabbed index sheet shall be AICO Gold-Line Indexes or equal.

C. The manuals shall be organized as follows:

SECTION I: Start-Up & Operation

Contractors and Vendors
General System Description
Detailed Start-Up Procedure
Automatic Temperature Controls
Fire Sprinkler System

SECTION II: Maintenance Instructions

Plumbing & Piping
Heating & Ventilating
Maintenance & Lube Table

SECTION III: Balance & Test Report

Air Balance Report
Water Balance Report
Test Run Report
Equipment Data Sheets
System Checks
System Commissioning Check List

D. The master index will list all items sequentially in the manual, including Section heading, sub-headings and groups of equipment.

E. The Contractor's and Vendor's sheet will list the name, address and phone number of the Mechanical Contractor and his subcontractors. It shall also include a complete list of equipment used, with name, address and phone number of the vendor.

F. The General System Description will consist of an overall general description of the Heating, Ventilating and Air Conditioning Systems and components.

G. The Detailed Start-Up Procedure will cover the step-by-step startup procedure for each piece of mechanical equipment. It shall be coordinated with the actual equipment on the job such as switches, starters, relays, automatic controls, etc. It shall include precautions and controls that must be actuated for equipment to operate properly.

H. The Maintenance Instructions shall consist of manufacturer's maintenance instructions for each piece of mechanical equipment installed. Instructions shall include installation; instructions, complete parts lists with numbers, recommended operation instructions, wiring diagrams, trouble

shooting, maintenance and lubrication instructions and name of vendor,and any other material published by the manufacturer applicable to the installed equipment shall be included.

I. The maintenance and lube table shall be a summary list of the mechanical equipment requiring lubrication. It shall show the name of the equipment location and type and frequency of lubrication.

J. The Balance and Test Reports shall be as specified in the Balance and Test Section.

K. The Equipment Data Sheets shall be provided for each motor-driven piece of equipment. Use standard form with all pertinent information provided such as rated and measured amps, volts, RPM, pressure drops, etc.

1.4 SYSTEM COMMISSIONING

A. The System Commissioning shall consist of field verifying and certifying that the mechanical system is properly installed and is fully operational.

B. Mark each item on the check list either "Complete" or "Not Applicable." Prepare Check List similar to the following list. Under "General Items," check list shall be completed for each piece of equipment such as Pump P/1, Supply Fan SF/1, Relief Fan RF/1, etc. When System Commissioning is complete submit check list and written certification to Architect. The Final Mechanical Inspection shall not be scheduled until System Commissioning check list is acceptable to the Architect.

C. Check List:

	Completed	N.A.
1. General Items:		
Bearings Lubricated	[ ]	[ ]
Rotation Correct and Free	[ ] [ ]	
Correct Size Thermal Overload Installed	[ ] [ ]	
Shipping Restraints Removed	[ ] [ ]	
Equipment Secured in Place and Seismically Braced	[ ]	[ ]
Equipment Clean and Free of Debris	[ ]	[ ]
Vibration Isolators Correctly Located with Proper Springs	[ ] [ ]	
Motors Not Overloaded	[ ] [ ]	
Equipment Nameplates Clean and Accessible	[ ]	[ ]
2. Life Safety Items:		
Systems Completely Tested and Signed Off by All Appropriate Authorities	[ ] [ ]	
Pipe and Equipment Identified	[ ] [ ]	
Valves Tagged	[ ]	[ ]

3. Piping Systems:

All Service and Balancing Valves in Place, Open, & Accessible	[ ]	[ ]
Air Vents in Place and System Free of Air	[ ]	[ ]
Expansion Tank Properly Located and Charged with Air	[ ]	[ ]
Air Eliminator Properly Located and Piped	[ ]	[ ]
No Leakage in Piping Systems	[ ]	[ ]
Water Treatment Systems in Service	[ ]	[ ]
Thermometer Wells in Place and Properly Located Insulation Completed	[ ]	[ ]
Pressure/Temperature Taps Installed	[ ]	[ ]
System Completely Filled and Static Pressure Proper	[ ]	[ ]
System Thoroughly Flushed and Clean	[ ]	[ ]
Start-Up Strainers Removed	[ ]	[ ]
Permanent Strainers Installed with Proper Sleeves Strainer Sleeves Clean	[ ]	[ ]
Strainers Piped for Easy Removal of Sleeves. Service Valves in Place. No Insulation Over Caps.	[ ]	[ ]
Dirt Pockets Installed	[ ]	[ ]
Flow Measuring Stations in Place. Proper Flow Direction. Gauge Tappings Turned Up. Nameplate Accessible. Correct Piping Length from Disturbances.	[ ]	[ ]

4. Coils:

Piped Correctly. Counterflow and Water Flow Upward	[ ]	[ ]
Fins Combed	[ ]	[ ]
Provisions for Pressure and Temperature Measurement Provided	[ ]	[ ]

5. Duct System:

Ductwork Clean	[ ]	[ ]
Access Door Tightly Closed, Gasketed with Proper Hardware	[ ]	[ ]
Fire Dampers and Smoke Dampers Open	[ ]	[ ]
Balancing Dampers in Place, Open and Locked with Accessible Operators	[ ]	[ ]
All Terminals in Place	[ ]	[ ]
Minimum Allowable Duct Leakage has been Tested and Verified	[ ]	[ ]

	Minimum Friction and Dynamic Loss		[ ]	[ ]
	Openings in Walls & Shafts for Air Transfer		[ ]	[ ]
	Insulation Completed		[ ]	[ ]
6.	Fans:			
	Correct V-Belt Drive Installed		[ ]	[ ]
	V-Belt Drive Aligned		[ ]	[ ]
	Drive Screws and Keyways Tight	[ ]	[ ]	
	Proper Belt Tension		[ ]	[ ]
	Flexible Connection Properly Installed	[ ]	[ ]	
	Belt Guards in Place		[ ]	[ ]
	Minimum of Negative System Effect		[ ]	[ ]
7.	Filters:			
	Clean, Specified Cells Installed	[ ]	[ ]	
	No Bypass Around Filters	[ ]	[ ]	
	Filter Gauge Installed and Calibrated		[ ]	[ ]
	Spare Cells on Site		[ ]	[ ]

END OF SECTION 15950

DIVISION 16 - ELECTRICAL

Section 16001	Electrical General Provisions
Section 16070	Electrical Connections for Equipment
Section 16080	Demolition
Section 16110	Conduit Raceways
Section 16120	Conductors and Cables
Section 16135	Electrical Boxes and Fittings
Section 16136	Supporting Devices
Section 16140	Wiring Devices
Section 16452	Grounding
Section 16510	Interior and Exterior Building Lighting
Section 16561	Occupancy Lighting Control and Equipment
Section 16740	Telephone/Data Systems (Raceways)

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.	Electrical Boxes and Fittings	16135
7.	Supporting Devices	16136
8.	Wiring Devices	16140
9.	Grounding	16452
10.	Interior and Exterior Building Lighting	16510
11.	Occupancy Lighting Control and Equipment	16561
12.	Telephone/Data 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.

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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, etc. See Division 2, Sitework, and other portions of Division 16, for material and installation requirements.

D. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, etc. See Division 5, Metals for material and installation requirements.

E. 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.

F. 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.

G. 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.

H. 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 NOT INCLUDED IN THIS DIVISION:

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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. Energy management/temperature control system; both line and low voltage including conductors and conduit.

1.6 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.

1.7 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.

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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.

1.8 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of $200.00 for the third review and any additional reviews required.

2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.

3. Certifications shall be written or in the form of rubber stamp impressions as follows:

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4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed_____.

Position_____ Date

5. Observe the following rules when submitting the Shop Drawings and Brochures.

a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

b. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

c. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.9 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.

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(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.

1.10 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

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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)

(Name of General Contractor)

By _____ Date

(Name of Electrical Contractor)

By_____ Date

1.11 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.

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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.

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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.

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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 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.

3.8 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

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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.

3.9 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.

3.10 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

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SECTION - 16070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 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 section for control system wiring; not work of this section.

C. 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).

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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

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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.

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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, roofing, 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. 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. Re-used raceway shall meet all requirements for new installations.

I. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

J. 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

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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

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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. MC CABLE: Not acceptable.

G. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

H. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

I. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

J. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

K. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1,

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and Style A.

L. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

M. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

N. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

A. GENERAL:

1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".

B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:

1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.

C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:

D. ANSI/NEMA TC 9, match to duct type and material.

E. HDPE CONDUIT: Not acceptable.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. 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

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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. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:

a. Install in electric metallic tubing (EMT); except in poured walls, with one side in contact with grade, below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in GRC or IMC. In suspended slabs, install in EMT. Encase non-metallic duct 1-1/4" and larger in concrete. See duct banks.

B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

C. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install

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lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.

D. Comply with NEC for requirements for installation of pull boxes in long runs.

E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

F. Replace all crushed, wrinkled or deformed raceway before installing conductors.

G. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device which supplies uniform heat over the entire area without scorching the conduit.

H. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.

I. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.

J. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

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K. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

L. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.

M. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

N. Raceway installation below grade:

1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.

2. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

3. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

O. Raceway installation below slab-on-grade, or below grade:

1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a minimum of 4” below gravel sub-base. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and 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

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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.

P. Raceway installation in hazardous locations:

1. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.

2. 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.

END OF SECTION 16110

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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)

C. Applications for conductors and cables required for project include:

1. 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:

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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. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.

B. Provide color and coding of conductors as follows:

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

C. Provide colors for switch legs, travelers and other wiring for branch circuits different than listed above.

D. Provide #10 AWG neutral conductor for all three and four wire fluorescent circuit home runs.

PART 3 - EXECUTION

3.1 INSTALLATION:

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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

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bodies shall not contain splices.

J. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. 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.

END OF SECTION 16120

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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

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PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x1-1/2". Provide minimum 2-1/8" depth for boxes with three or more conduit entries.
2. Provide an ‘FS’ box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

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:

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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 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. Wiremold/Walker 880CS2-1 827B 828R 828GFI TC CM-MAB with (2) Cat 6 jacks

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.

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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

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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

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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

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3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

END OF SECTION 16136

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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

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:

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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

C. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide 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

D. WIRING DEVICE ACCESSORIES:

1. WALL PLATES:

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a. Provide stainless steel coverplates for wiring devices; to match wiring devices to which attached.

E. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 406-8 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

a. Intermatic WP1020 or WP1030
b. P&S WIUC10C or WIUC20c

PART 3 – EXECUTION

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in 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.

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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, kitchens, outdoors or within six feet of any sink. Provide in elevator equipment rooms and pits.

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

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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. Enclosures
2. Systems
3. Equipment
4. Other items indicated on drawings

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

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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.

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), 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.

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 raceways shall include copper grounding conductor sized in accordance with NEC.

D. 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.

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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.

E. 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.

F. Provide bonding wire in all flexible conduit.

END OF SECTION 16452

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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. Types of lighting fixtures in this section are indicated by schedule and include the following:

1. Fluorescent

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Comply with NEC 410-65C for all recessed incandescent light fixtures. Provide lighting fixtures which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on interior and exterior building lighting fixtures.

B. SHOP DRAWINGS:

1. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet. Submit all available standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be

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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. INCANDESCENT AND FLUORESCENT LAMPS:

a. General Electric Co.
b. Osram Sylvania
c. Phillips Lighting Corp.

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

2. Comply with manufacturer's written recommendations for all lamp ballast combinations.

3. Equip outdoor fixtures with low temperature starting ballasts.

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C. CBM LABELS:

1. Provide fluorescent-lamp ballasts, which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

D. 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.

E. FLUORESCENT LAMP BALLASTS: - (ELECTRONIC):

1. 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

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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.

F. CBM LABELS:

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1. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

G. 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).

H. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the

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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:

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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

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SECTION 16561 – OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-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 occupancy sensor work is indicated by drawings and schedules.

B. Types of occupancy sensors in this section include the following:

1. Dual Technology Ceiling Sensor w/ Control Pack

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors which have been UL listed and labeled.

B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, interconnection diagrams and any related accessories.

B. Submit scaled drawings with lighting fixtures shown clearly marked by manufacturer showing proper product, location and orientation of each sensor.

PART 2 - PRODUCTS

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2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

A. DUAL TECHNOLOGY CEILING SENSOR: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic (microphonics) and infrared technologies in a single unit.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use internal microprocessor for motion signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm which adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour in response to recognition to false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce either PIR or ultrasonic sensitivity in response to false on condition.
9. Sensor microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
10. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
11. For airflow which is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
12. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar.
13. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
14. Sensor shall have selection settings for the following dual technology schemes:

    a. High Sensitivity and High Confidence (miser mode)

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15. Sensor shall be available with either 180 degrees or 360 degrees coverage pattern.
16. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.
17. Sensor shall have a variety of mask inserts for PIR coverage rejection to prevent false tripping.
18. Transducers shall be protected from tampering.
19. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
20. Sensor shall have adjustable sensitivity from 0% to 100% for both ultrasonic and infrared.
21. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
22. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.
23. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
24. Sensor shall have two (if 180 degree) or three (if 360 degree) real time LED motion indicators visible from the front of the unit: Red = infrared; green = ultrasonic.
25. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-ATD Series
    b. Sensor Switch-CM-PDT Series
    c. Wattstopper-DT Series
    d. Mytech-Omni-DT Series
    e. Lithonia - LMTO Series
    f. Novitas – 01-300/310

B. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:

1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.
2. Control module shall be available in versions to accept 120, and 277 VAC line voltages.
3. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).
4. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.
5. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.
6. Relay function shall not require more than 5 mA control current to operate.

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7. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.
8. Control module shall be sized to fit inside a standard 4” x 4” junction box.
9. Control module shall be equipped with a 1/2” EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
10. Control module shall be equipable with accessory 1/2” EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
11. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.
12. Subject to compliance with the above requirements, provide models of one of the following:

    a. Hubbell-CU Series
    b. Sensor Switch-PP-20 Series
    c. Wattstopper-BEP Series
    d. Mytech-MP Series
    e. Lithonia - LPCS Series
    f. Novitas – 13-051

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

D. Contractor shall be on site as required, to adjust lighting control units for proper operation.

E. Mount the switchpack in a standard 4" junction box or extension through a ½" KO

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in the cover plate. Refer to manufacturer supplied mounting instructions.

F. Provide 5 spare sensors for each type used on project.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.
B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
C. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 16561

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SECTION 16740 – TELEPHONE/DATA SYSTEM (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. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. The extent of telephone/data system work is indicated by drawings and is hereby defined to include, but not be limited to raceway, outlets, device plates, 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/data including but not limited to, raceway, outlets, device plates, and miscellaneous items as required.

B. Provide 4" square box with appropriate plaster or tile ring.

C. Provide telephone/data 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.

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PART 3 - EXECUTION

3.1 INSTALLATION OF TELEPHONE/DATA SYSTEM:

A. GENERAL: Install raceway system as indicated to comply with NEC and recognized industry practices. Run ¾" conduit from each telephone/data outlet to terminal backboard, cable tray, or terminal cabinet.

END OF SECTION 16740

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